

The International Political Economy of Fishery Management :
the case of pirate fishing off the Senegalese coast.



Jonathan Stilwell

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Declaration of originality.

The author hereby declares that the contents of this dissertation, unless specifically indicated to the contrary, are his own work and that the thesis has not been submitted simultaneously, or at any other time, for another degree.



Jonathan Stilwell

Servez l'humanité comme le plus grand vous-même.
'Serve humanity as your greater self.'

- Paramhansa Yoganada

Abstract.

In 2002, at the Johannesburg World Summit on Sustainable Development (WSSD) a plan emerged to restore the approximately 60% of global fish stocks, which have been fished to the brink of destruction, to biologically sustainable levels by 2015. This plan was made in an attempt to secure greater food security for many of the world's people. However, severe Illegal Unreported and Unregulated (IUU) fishing in many of the world's fisheries makes the realisation of such a plan difficult, especially in the developing context where there are little means for regulating ocean fishery usage effectively. This dissertation examines the nature of IUU fishing, and attempts to find possible solutions to this pervasive problem for many coastal states in the developing world. The methods employed by the study comprise a review of literature pertaining to both theoretical and practical dilemmas, as well as a more focussed examination on IUU fishing in Senegal. Using a process of inductive analysis the case is contrasted with the theory in view of finding routes to improved resource exploitation mechanisms in the region. The study concludes that the global over fishing crisis may create a window of opportunity for developing countries in possession of such resources to better manage their fisheries and take advantage of possible comparative advantages in international trade in fish products, thus improving balance of payments problems. However in order to achieve this, as a first measure the problem of IUU fishing must be eradicated.

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List of abbreviations.

AC	Aggregated Cost.
C	Catch.
CCRF	Code of Conduct for Responsible Fisheries.
CNPS	Senegalese Independent Fish-workers Association.
Credetip	Centre of Research for the Development of Intermediary Fishing Technologies.
DD	Demand.
EEZ	Exclusive Economic Zone.
EU	European Union.
FAO	Food and Agriculture Organisation.
Fenagi	Federation of Fishing Industry Interest Groups.
FOC	Flag Of Convenience.
G	Growth.
GT	Gross Tonnes.
H.O.	Heckscher Ohlin.
IMF	International Monetary Fund.
IPOA	International Plan of Action.
ITQ	Individual Transferable Quota.
IUU	Illegal Unreported Unregulated.
NEPAD	New Plan for Africa's Development.
MSC	Marine Stewardship Council.
MSY	Maximum Sustainable Yield.
OSY	Optimal Sustainable Yield.
P	Price.
Q	Quantity.
SC	Shared Cost.
SFM	Sydney Fish Market.
SS	Supply.
TAC	Total Allowable Catch.
UN	United Nations.
UNCLOS	United Nations Convention on the Law of the Sea.
WB	World Bank.

WCPSHDF	Wise Coastal Practices for Sustainable Human Development Forum.
WDD	World Demand.
WSSD	World Summit on Sustainable Development.
WTO	World Trade Organization.
YE	Yield Effort.

Chapter 1. Introduction.

1.1. Coasts in Crisis.

Mbour is a fishing village 50 miles south of Dakar on the Africa's West coast. Traditionally much of the nutrition for the inhabitants of this town has come from once rich fish stocks near the shore. Since the advent of massive foreign fishing enterprises off Africa's west coast, fish populations have begun to dwindle to the extent that local fishermen have been forced to spend as long as three days or more at sea in order to satisfy their needs. Cheik Gueye, 16, was one such fisherman. He had set out to sea with six other fishermen for three days in search of once plentiful fish stocks. During one of the long nights spent by the fishermen sleeping curled up on piles of oily nets, a massive industrial trawler, fishing inside the area reserved for artisan fishermen, ploughed through the small wooden pirogue. Cheik Gueye had fastened himself to the boat with rope so that a freak Atlantic wave would not topple him overboard. His colleagues said that as the steel hulled trawler splintered their boat, Cheik disappeared under the water and never resurfaced.

Arona Diagne, the president of the Senegalese independent fish workers' association, (CNPS), points out that over the last two decades the lives of more than 300 fishermen have been lost in similar incidents in the waters around Mbour.

The Mbour fishermen rarely know where the boats responsible for the accidents come from. Often they are fishing illegally inside the area reserved for the artisan fishermen, but the boats cover their identity numbers in mud. They turn off their lights so they cannot be seen from the shore at night, with the inevitable result that they cannot see the pirogues either. According to the local fishermen, when the accidents happen, the trawlers never stop.¹

Incidents such as this one are becoming alarmingly characteristic of the competition between artisan and industrial fishing operations in fisheries plagued by large-scale pirate fishing enterprises. The United Nation's (UN) Food and Agriculture Organisation (FAO) has identified the phenomenon of pirate fishing as "illegal, unreported and unregulated fishing".² However, this definition may require extending to include the illegal or irresponsible practices of licensed fishers. Fishing without authorisation, failing to report catches or failing to report catches accurately, and fishing in a manner contrary to authorisation threatens responsible fisheries manage-

¹Brown, P. (2002) *Summit agrees deal to save fish*. www.guardian.uk.

²Notes on IUU fishing. www.somaliwatch.org.

ment.³ In this dissertation the case of the pirate fishing problem in Senegal shall be used to describe some of the important challenges associated with the regulation of fisheries in the developing world, where the problem of pirate fishing is prominent. The research aims not only to describe the key issues but also to develop a generalizable theoretical model which may be used as a road map for the formation and implementation of effective policy controls for a more sustainable international fishing regime.

This dissertation contains six sections. The first section introduces the reader to the problem, the research methodology and the hypothesis of the study. The second section informs the reader of some of the contextual issues pertaining to the problem of IUU fishing and enhance an understanding of the nature of the human relationship with the natural environment and its resources. This section also aims to make a case for further examination of, and action against, IUU fishing. The third section analyses the existing literature pertaining to the research topic. This literature review begins with by outlining some of the literature having a bearing on the theoretical causes behind IUU fishing, but later moves on to present several of the existing theories for regulating fishery usage as well as describing more explicitly some recent plans which attempt to deal with the IUU fishing dilemma. The literature review ends with a description of how this research will contribute to the existing body of knowledge apropos IUU fishing. The author makes a case for this research as a piece which marries economic and political theory to the more specific and practical problem of tempering the prevalence of fishery mismanagement. The fourth section describes some of the practical considerations concerning the inefficiencies associated with pirate fishing and, more specifically, how these inefficiencies bear upon the Senegalese ocean fishery. The fifth part offers a new model for regulating ocean fisheries in the global South (also referred to as the political South) where funds and impetus for regulation are in short supply. This model is based on aligning the true economic costs of fishing with the amounts paid by fishers to exploit fishery resources where the aligning of these two factors involves an increase in the cost of fishing. By applying the model to the case of the Senegalese fishery, the aim has been to show how a mechanism for providing accurate information pertaining to fishing activities may empower policy makers to not only run fisheries more effectively but also to take better advantage of a comparative advantage in the production of fish re-

3 Bray, K. (2000) *Illegal, Unreported and Unregulated (IUU) Fishing*. www.euroopa.eu.

sources, thus improving the position of certain less developed states in the system of international trade. The concluding chapter discusses the arguments made within the thesis with respect to the implications of an increase in the price of fish for the peoples of the developing (meaning Third) world as well as some of the challenges associated with achieving a multilateral response to the global fisheries crisis.

1.2 Research Methodology.

Post-modern theorist, Stanley Fish, has argued that there exists a cleavage between theory and its practical application, which is so great that it is sometimes scarcely worthwhile to become embroiled in elaborate theoretical endeavours.⁴ The findings of this research, however, are deeply rooted in theory. There are two main reasons for this. The first is that as an academic thesis, it must adhere to the discursive norms of the academic process. There can be little doubt that this process requires certain obligations to be met in terms of foundations in the relevant schools of thought and, at least, a basic knowledge of those that may seem less relevant at first inspection. The second reason emerges as a result of the instrumental usefulness of theory as a means to sketching dilemmas and ways of deconstructing them. This is done to better understand the nature of specific problems, and indeed the best route towards repackaging problems to create better problem solving systems and more gratifying status quos.

Fishery regulation and the concomitant dilemmas are a field in which some fine academe has yielded some interesting and credible works regarding approaches. Not only have theorists offered economic models and the means for understanding and addressing the challenges associated with fishery resource use, but they have also outlined some of the causes of these problems through the use of rational choice and game theories relating to common property resources. However, as Elinor Ostrom has argued, policy mandates on common pool resources have been based upon theory which has not connected to the precise nature of particular problems in a consequential manner.⁵ The author suggests that thus far theoretical approaches have been somewhat too limited to provide the best possible approach to resource management, thus creating a need in the field for theories which can speak more eloquently to the prescriptions man-

⁴ Fish, S. (1989) *Doing what comes naturally : change, rhetoric, and the practice of theory in literary and legal studies*. Durham, NC, Duke University Press, p 4.

⁵ Ostrom, E. (1990) *Governing the commons*. Cambridge, Cambridge University Press, p 7.

dated by the specificity of particular problems. Furthermore the problem of pirate or IUU fishing has not yet been addressed by academics in a comprehensive way. Thus one of the key challenges for this research is in finding a credible research methodology in the absence of a grand bank of literature pertaining to illegal fishing. As a result, the following methodology has been chosen as the finest means available for synthesising an academically credible and practically useful thesis on a little researched topic.

The key points of departure for this work have been informed by a theoretical framework which is characterised by three core and cross-cutting theoretical discourses: ecological preservationism, development economics, and fishery economics. From this base, the analytical framework comprises a literature review, using inductive analysis to answer descriptive, theoretical, and conceptual questions which emerge from the various primary and secondary sources consulted.⁶ Primary sources include official government and non-government organisation documents, while the secondary sources include books, newspaper articles, journal articles, news reports, and interviews. Data collection has therefore been restricted to the already generated data contained within these texts; thus one of the limitations for the study has emerged as a result of the lack of comprehensive primary data in the form of survey results. In an attempt to provide for Ostrom's specificity related concerns, the case of Senegal's offshore fishery has been chosen as a means for overlaying the literature with a real world experience. The particular case of Senegal's offshore fishery has been chosen with respect to the objectives of the study, which are to provide insights into possible solutions for an IUU fishing problem in a Third World state fishery characterised by Flag of Convenience (FOC) fishing enterprises and conflicting user group interests. The case of the Senegalese fishery bears all of these necessary hallmarks and may be classed as a country case study.⁷ Literature review and case study techniques have not only been chosen for the purpose of triangulating the research problem with the aim of providing a new model for fishery regulation but also as a means of being reflexive upon the model by testing it against possible inadequacies.

The first objective for the study is to outline the problem of illegal fishing by way of a review of current and past events literature. This will form the basis of the problem statement and, there-

6 Mouton, J. (2001) *How to succeed in your masters and doctoral studies*. Pretoria, Van Schaik, p 179.

fore, the justification for the research which will include a theoretical framework explaining the need to protect environmental resources. Second is conceptualisation of the problem within the relevant literature pertaining to fishery usage. This section will be characterised by a review of literature pertaining to IUU fishing problems while the causes of IUU fishing are outlined in terms of rational choice theory. Later in this section, some economic approaches to fishery management will be outlined for the purpose of providing the reader with a frame of reference for the later parts of the thesis where economic approaches to the problem of pirate fishing are used to formulate a new model for the regulation of fisheries characterised by IUU fishing. The third aim of the research is to provide a new model for dealing with the problem of IUU fishing within the developing or Third World context. The new theoretical framework for the management of fisheries is achieved via conceptual analyses. This model has been tested for credibility through its hypothetical application to the real world case of Senegal's fishery, using hypothetical figures and real world circumstances as the basis for this experimentation.

Although these three basic aims form the core of this thesis, some auxiliary sections have been included to verify and legitimate the findings in the core sections, as well as to provide the reader with some background knowledge regarding the following topics: the historical context from which progress is desired; the need for, and reasoning behind, environmental preservation, the international experience regarding fishery issues thus far, as well as how the literature bears upon the real world circumstances faced by the Senegalese fishery.

In the final sections of this thesis, recommendations and a conclusion will be made bearing upon the findings that have emerged in the previous sections.

A process of peer review has been employed as a means for enhancing the credibility, validity, and reliability of the research methodology.

1.3. Hypothesis.

New market-based estimations regarding the economic costs associated with pirate fishing can provide the framework for the formulation of policies which will enable more effective

7 Babbie, E. & Mouton, J. (1998) *The practice of social research*. Cape Town, Oxford University Press, p 281.

regulation of fishery resources in developing states. By informing a more accurate price of fish, and increasing the cost of fishing through policy measures in tune with this market information, fishery resources may play a pivotal role in the development of coastal states in the Third World. This objective may be achieved through reorganising institutional arrangements in view of giving localised fishing operations a comparative advantage in the production of fish products, which in turn can provide a necessary medium for improving balances of payments in Third World states.

Chapter 2. Background to the Study.

2.1. Humans and the Natural Environment.

The cleavages between social behaviour, economic development, and environmental degradation are ones which have historically demanded philosophical discussion. The central issues pertain to the paradoxical relationship existing between human and or social welfare and the welfare of the natural environment upon which the well-being of almost all living things depends. It may be useful to place attempts at evaluating and alleviating environmental damage within a theoretical framework demonstrating the relationship between humans and the natural environment as a pretext for such preservationist endeavours. Traditionally environmental action has been based on often-conflicting ideological positions. Reparative environmental action has theoretical foundations based on two complementary schools of thought. *Conservationists* view environmental resources in terms of their instrumental usefulness, which provides justification for the stewardship of humans over the environment. *Preservationists*, on the other hand, view the environment and its natural resources as being intrinsically valuable for their beauty, and inherently precious simply because they exist.⁸

Within these doctrines, the human obligation to the natural environment falls under three broad principles known as *stewardship, utilitarianism, and the significance of life*. Stewardship is based on principles which suggest that humans are stewards of the environment and, as such, not only have the right to exploit its resources but also a duty to protect them. Utilitarianism bases the human obligation to the environment and its inhabitants upon a responsibility to advance the greatest good for the greatest number. This doctrine requires humans to take stock of the interests of sentient non human beings while conducting themselves within the earth's habitable spaces. The significance of life principle acknowledges that life, sentient or not, is precious and must be revered. This notion is indelibly associated with the work of Albert Schweitzer who recognised that the natural environment, living and non-living, forms crucial life supporting networks for other living things, and should be preserved for respect and veneration for life.⁹

The problems associated with over fishing are precariously balanced between these principles. It

⁸ Connely, J & Smith, G. (1999) *Politics and the environment*. London, Routledge, p 9.

⁹ Ibid, pp 11- 18.

is virtually impossible to make reliable assumptions about the harvesting of fish products relative to utilitarian principles as a result of the difficulty that one is likely to encounter in attempting to aggregate net welfare of the planet's species relative to the act of over fishing. The stewardship and the significance of life notions appear to offer more applicable foundations for the disciplined employment of fish resources, as both of these principles are overtly opposed to the annihilation of natural resources and other species. Hence, concepts of sustainable resource use are founded upon principles which not only stress the rational need to conserve useful resources but also a view which appreciates other things as having a birthright to their own place in the universe.

2.2. A Legacy of Plunder.

The colonisation of Africa came hand in hand with economic structures and discourses that reflected hegemonic power structures between colony and colonial master. Before the 1940s a predominant view was that economic development in West Africa would be the product of colonial development in the region and associated welfare programmes.¹⁰ Later, during the period between the 1940s and 1950s capital investment and the expansion of production in West Africa was viewed as trumps for ensuring the developmental hopes of the region. Unfortunately, problems with insufficient economies of scale gave the new Africa-based producers a comparative disadvantage in the production of secondary products when they attempted to compete with massive operations in already industrialised countries for a slice of the world market. This problem led to the current situation, with West African states trading primarily in raw material exports, the only viable alternative for their infant economies.¹¹ Hence, Africa became a source of primary products which could be imported and processed by western powers. Although the African continent provided much of the raw materials required for a developing global economy, the economic benefits were somewhat meagre in relation to those received by the colonial powers.¹² As Senegalese theorist, Boubacar Barry, has suggested, neo-colonial discourses, particularly in Senegal, are the result of pre-colonial power arrangements.¹³ As such, these discourses have become entrenched into the power relations that determine, to some extent, the

10 Rimmer, D. (1984) *The economies of West Africa*. London, George Weidenfield and Nicolson.

11 Ibid. p 216.

12 Jones, A. (2003) Personal communication. *Interview with A. Jones*, February, Pietermaritzburg.

13 Rimmer, D. (1984). Loc cit.

country's posture in the international political economy.¹⁴ To this day, these modalities are perpetuated by economic power relations, which appear to be inhibiting the economic development of many developing countries.¹⁵ Many African states currently spend a large portion of the income earned from the sale of natural resources on debt servicing. Senegal, for example, is indebted to the World Bank to the tune of \$3.8 billion. In 1999 this country spent \$323 million servicing this debt, which incidentally, is \$311 million more than the European Union (EU) paid in the same period to exploit one of the country's few natural resources, their fishery.¹⁶ To add insult to injury, many of the fish products extracted from Senegal's fisheries are processed in the west and sold back at an inflated price just a few miles from where they were caught, doing more damage to the state's already precarious balance of payments.¹⁷

Fish are not only an important commodity for global trade, but form a staple part of the diet for 85 percent of the Senegalese population as well as providing employment to massive sectors of the country's work force. The artisan fishing industry employs over 10 percent of the population of Senegal (approximately 600 000 people).¹⁸ With water shortages in much of the interior of the country retarding agricultural activities, people migrating to the coast in search of uncommon jobs are often compelled to begin fishing for food and to make money, thus adding additional pressure to an already overburdened resource.¹⁹ As African fish stocks dwindle, local fishermen are not only losing their lives but also their livelihoods. Since catches have decreased, economic pressures have increased, and social fragmentation continues to develop as a result. Aside from the social and economic impacts of this over-fishing, the environmental consequences are enormous, as ironically the use of Senegal's precious resource appears to be reinforcing underdevelopment rather than stimulating economic growth.

With the rapid depletion of fish stocks in Europe and Asia, trawlers from France, Spain, Italy, Taiwan and several former Soviet republics have targeted the waters off the west coast of Af-

14 Barry, B. *The subordination of power and the mercantile economy*, in Cruise O'Brien, R. (1979) *The political economy of underdevelopment*. London, Sage.

15 Frieden, J. (2000) *International investment and colonial control*, in Frieden and Lake. *International political economy*. (2000). London, Routledge, p 110.

16 Wilson, J. (2000) *op cit*.

17 *Loc cit*.

18 *Op cit*, p 2.

19 Notes on Senegalese fishery dilemma. www.guardian.co.uk.

rica to satisfy their countries' appetite for fish products. The fish they hunt in Senegal are mainly migratory sardines, which swim up and down Africa's west coast passing through the territorial waters of Mauritania before reaching Senegal. The migratory behaviour of these sardines means that over-fishing in one area can lead to the collapse of an entire population upon which people and animals in many, often far off, regions depend. Problematically, the regions where the regulations are most lenient are also the ones which are favoured by large fishing enterprises,²⁰ hence the incentives for countries with fishery resources to implement rigid policy controls are diminished by the desire to entice foreign fishing companies to their waters for the sake of the quasi-lucrative fishing deals that accompany the trawlers. In 2000 the EU had an agreement with the Mauritanian government allowing 22 trawlers of unlimited capacity to fish the local waters. The main beneficiaries of the deal have been the Dutch pelagic fleet and its new fleet of "super trawler" - 144 metres long, roughly the size of a cross channel ferry, capable of carrying 7 000 tons of fish 22 000 miles.²¹

Another deal allowed 78 EU boats to fish the Senegalese coast for an annual sum of 7.5 million pounds. Although the EU has stated a commitment to sustainable fishing practices, the fishermen in Senegal say that the enormous appetite of the foreign trawlers is annihilating the local sardine population.²² More recently in 2002, after banning EU boats from their waters for six months, the Senegalese government managed to land a more favourable fishing deal with the Europeans. The new deal emerged as the result of unhappiness among the Senegalese about the unwillingness of the EU to compensate them sufficiently for the use of their fish resources. In a four year deal worth 64 million euros, the Europeans have agreed to: pay 16 million euros annually (4 million less than the Senegalese had demanded but 4 million more than the previous protocol); increase the number of Senegalese fishermen to be employed from 33 to 50 percent; decrease the quantity of demersal fish (species living near the sea bed) caught from 10 000 Gross Tonnes (GT) to 8000 GT (in the interests of the artisanal fleet); and cease to employ the environmentally catastrophic pelagic fishing techniques. Two of the additional innovations of this new agreement are the implementation of a 2-month biological rest period for helping fish stocks to replenish, and the installation of observers on board EU vessels to help Senegalese

20 Ulph, A. (1999) *Trade and the environment*. Northampton, Edward Elgar, p 198

21 Wilson, J. (2000) *Loc cit*.

22 *Ibid*.

authorities monitor the deal.²³ In spite of these measures though, environmentalists remain concerned that the deal is not sufficiently aligned to the ecological capacity of the fishery.²⁴ These concerns become particularly alarming when consideration is given to the incidence of pirate fishing in this industry. Pirate, or FOC vessels, are believed to originate from about 80 different countries, but most come from Taiwan, the EU (mainly Spain), Panama, Belize, and Honduras. The owners of the ships typically pay a fee to have their vessels registered in a country that has not ratified (and is therefore unbound by) the relevant international treaty agreements pertaining to fishery usage. This enables these boats to roam the high seas, fishing wherever and whenever they please under the protection of the sovereignty of the state where the ships are registered. Estimates suggest that over 75 percent of all pirate vessels are registered in Honduras, Panama, Belize, St. Vincent, or the Grenadines.²⁵ Thus for a small fee pirate fishing companies can remove millions of dollars worth of fish from virtually wherever they see fit.²⁶ Taking advantage of this loophole in international law and disguising their fishing operations within fictitious companies, pirate fishers are able to extract fish from the oceans without paying any compensation for the use of the fishery, and in many cases without being identified. Even when such industrial trawlers are identified while fishing illegally, they are seldom penalised. "The industrial boats are very powerful with a lot of money and they can buy their way out of trouble. They corrupt the persons who are meant to stop them. The bribe is everything."²⁷ As the latest fishing deal between the EU and Senegal allows little or no room for additional exploitation of Senegalese fishery, the prevalence of IUU fishing in the area may pose a major threat to the longevity of this fishery.

Although the UN's FAO has recognised pirate fishing as a major threat to the sustainability of the world's fisheries,²⁸ the eradication of this phenomenon remains a politically contentious issue. A plan emerged at the Johannesburg World Summit on Sustainable Development to restore 60% of the world's fish stocks by 2015. A total of 189 countries ratified the part of the plan which involved creating protected zones, while only 130 ratified the section which attempts to

23 *West African fishery news*. www.afrol.com.

24 *Ibid*.

25 www.oneworld.org. Loc cit

26 *Ibid*.

27 www.guardian.uk. Loc cit.

28 www.somaliwatch.org. Loc cit.

arrest and penalise pirate fishing vessels (ships that are fishing outside of their designated jurisdiction).²⁹ Indeed the failure of 59 states to mandate the penalisation of pirate fishing is alarming. Although one should be cautious about drawing rigid conclusions about such statistics, it does not seem unreasonable to conclude that many states are primarily concerned with advancing their own interests to the detriment of disenfranchised peoples who depend heavily upon fish stocks for their well being. Yet in an ironic Gestalt shift many vulnerable states such as Senegal can scarcely afford to regulate their own fisheries without international cooperation.³⁰ Given that only 130 states ratified this section there is scope for truly devastating pirate fishing operations, especially when we consider the fishing and storage capacity of modern vessels. Regardless of so called sustainable development reforms, the existence of a demand for scarce fish resources leaves a supply deficit, which appears to be all too easily satisfied by politically below board fishing practices. Hence the old patterns of core periphery exploitation appear to be perpetuated in spite of modern endeavours for reform, thereby reinforcing the impetus for regulating the fishing industry in order to avoid gross exploitation of these precious resources.

2.3. Cost Associated with Pirate Fishing.

The numerous problems associated with illegal and unregulated natural resource use may seem obvious, though the solutions are not. Key challenges related to attempting to police resource use are prominent in attempts to standardise resource usage among users of fisheries. Operating without quota restrictions, and unaccountable to any authority, pirate fishing has serious ramifications for the future well-being of global fish stocks.³¹ Unregulated fishing has thus far devastated fisheries to the detriment of those who rely upon their bounty for meeting their own basic needs, as well as large organizations with legitimate fishing licences. So great is the perceived threat that the United Nations Food and Agriculture Organization (UNFAO) has begun developing an international plan of action (IPOA) to combat IUU fishing. To date, however, progress has essentially been limited to the development of the new plan of action, with several papers having been commissioned for a global review of the problem, and several meetings having been held on the key and related issues.³² The challenge is important and may affect one because the threats associated with IUU fishing not only affect the economic interests of

29 Brown, P. (2002) *Summit agrees deal to save fish*. The Guardian, p 1.

30 www.ongeworld.org. Loc cit.

31 Wilson, J. (2000) Loc cit.

large fishing companies and governments, but have a direct effect upon the lives of millions of ordinary people.

Although the magnitude of the decline of Senegal's fish stocks is difficult to gauge, interviews with local fishermen suggest that the fish population has decreased to the extent that what could once be caught in one afternoon now takes three days or more.³³ Greenpeace, on the other hand, has estimated that a global figure of 27 million tons of by-catch alone is dumped back into the sea by pirate fishing vessels annually. Of the estimated 1300 industrial scale pirate fishing vessels world wide 345 are believed to frequent the waters in and around Senegal, removing massive quantities of fish and placing additional pressure on this over burdened natural resource.³⁴ Even the most conservative of estimates suggest that the pirate fishing is a serious problem. Suppose that half of the FOC fishing vessels suspected to frequent the waters around Senegal (345/2), fish once in a fishing season, and at half the capacity per outing of the large industrial trawlers licensed to fish Senegal's oceans (14000GT/2). We may now extrapolate a simple equation for a conservative figure regarding the amount of fish which may be removed illegally each season from Senegal's fishery. By multiplying the number of vessels number by the gross tonnage removed per outing, we can calculate the total tonnage poached. Thus $345/2 \text{ vessels} \times 14\,000 \text{ GT} = 172.5 \times 7000\text{GT}$ which gives us a figure of 1 207 500GT of illegally caught and uncounted fish. When compared with the volumes of fish removed by legal fishers, these estimates become even more alarming. Recent reports suggest that in terms of the latest fishing deal between the EU and Senegal, the EU nets 6 000 000 tons of fish per season while the Senegalese land 9 500 tons. At a conservative estimate then, pirate fishers may be removing 15 percent, or more, of all fish caught in Senegal's waters per season, and placing the resulting fish products in markets all over the world. This, needless to say perhaps, drives the market price of fish down, forcing legitimate fishers to fish harder for lower rents, thus placing additional pressure on global fish resources, and particularly in those places where regulations are easy to ignore.

The result of the depletion of these fish populations will surely become costly to the govern-

32 Bray, K. (2000) *Illegal Unreported and Unregulated (IUU) fishing*. www.eurona.eu.

33 www.guardian.uk. Loc cit.

34 Notes on international fishing dilemma. (2001) www.commondreams.org.

ments which depend upon big fishing deals for revenue as the value of the licences diminish in proportion to the destruction of fish stocks. Yet the true, and most profound cost of pirate fishing is to make fish resources incredibly difficult to regulate. While in the long term pirate fishing not only wreaks havoc for artisan fishing communities and the fish stocks themselves, but may have dire consequences for lucrative international trade arrangements as well as primary, secondary and tertiary industries. This is without making mention of any of the implicit consequences of the virtual eradication of various oceanic species.

Indeed the solution to over-fishing problems may now appear simple. Clearly what is required in these areas is an effective coastguard such as those presiding over some Canadian fisheries, unfortunately many African states, faced by an over fishing crisis, can scarcely afford such luxuries. Over fishing is costly to police, and the predominance of free trade arrangements makes demand side moratoria for restricting the demand for fish products similarly unviable. Hence it is difficult for countries to exclude certain products from their import bills for reasons of environmental prudence without contravening certain free trade agreements. Although environmental prudence has become a more prominent feature of international trade regimes, these measures appear to have been somewhat incomprehensive when it comes down to providing easy solutions for more effective fishery management, and the prohibition and regulation of illegal fishing. In fact, and in counterpoint, the phenomenon appears to be growing.³⁵ Furthermore, many states are somewhat obstinate on issues concerning trade and environmental prudence.³⁶ The well-being of fish resources remains important to humans, not only because many people have acquired a taste for fish, but also because fish products have long been hailed as a possible solution to global worries about food security. Moreover the demand for fish resources will continue to be fairly inelastic until acceptable substitutes can be produced at a reasonable cost. Given that developing affordable substitutes for fish products is likely to be a costly process, if possible at all, the impetus for establishing effective policies governing the use of fishery resources remains significant and credible. However, effective environmental policies not only require policy approaches to particular problems but also methods for evaluating and, where necessary, refining these policy measures.

³⁵ www.commondreams.org. Loc cit.

³⁶ www.somaliwatch.org. Loc cit.

The evaluation of environmental policies and their implementation typically requires vast amounts of information, and when policies are economic, meaningful information about economic activities such as the demand and supply functions are crucial ingredients for assessing the effectiveness of pertinent policies.³⁷ The discreet nature, and large scale of pirate fishing makes information regarding the quantities of fish removed from the ocean and sold in foreign places inaccessible to those who attempt to gather this information with a view to establishing policy controls for fisheries. The result of this lack of information makes meaningful evaluation and redefinition of existing policies, which have been designed to regulate fishery usage, impossible.

³⁷ Arnold, F. S. (1995) *The economic analysis of environmental policy and regulation*. New York, John Wiley & Sons, p 45.

Chapter 3. Literature Review.

3.1. Overview.

The key issues encompassed by the problem of pirate fishing are numerous. The linkage between the necessary biological equilibrium for a well functioning fishery and the drive for the economically efficient and profitable utilization of the resource are at the heart of many of the challenges associated with attempting, not only to eradicate pirate fishing, but to manage legal fishing in a more biologically and economically sustainable way. Economists may be able to offer economic models for fishery regulation (*ceteris paribus*), biologists methods for evaluating the health of fish populations, and political scientists explanations and explorations of the ways in which the changing usage of fish resources impacts on the lives of individuals, societies and organizations. However, what is required is an attempt to marry the offerings of each within a comprehensive fishery policy programme. Effective fishery policies and sustainable agreements between states must be informed by a broad based approach to the numerous challenges associated with attempting to achieve these goals. Indeed fish resources are a primary global food source as well as a lucrative key to economic emancipation for thousands of people in many parts of the world, yet in practice many states in possession of fish resources rarely have accurate knowledge pertaining to the state of their fishery populations, the amount of fish being harvested, the economic value of the resources being removed, or indeed by whom the resources are being extracted.

Although much has been written on common property dilemmas, and indeed fishery management, illegal unreported and unregulated fishing is a topic which has not featured highly on the agendas of the world's theorists. The relative literature vacuum has presented a challenge to the production of this thesis, and indeed to this review of literature. However, poor availability of literature should not be cause for abandoning such a project, but rather a good reason for pursuing it. Nevertheless this challenge remains to be overcome in order to contribute in a meaningful way to the body of knowledge concerning the regulation of IUU fishing in the political South. This literature review intends to outline some of the causes of the problems associated with fishery regulation, to summarise certain key economic approaches to fishery management, to conceptualize those approaches within a system characterized by pirate fishing, and finally provide the basis for theoretical avenues of hope for more effective fishery management within the context of the developing state. These steps will be taken as a way of providing the reader

with a working knowledge of both fishery economics as well as some challenges associated with attempting to eradicate pirate fishing. The first two sections are intended to form the basis of an analytical and theoretical framework for better understanding of fishery dilemmas, while the third bears heavily upon international experiences and government and non-government organization policy approaches to illegal fishing thus far. The international experience is examined with a view to providing a point of comparison for orienting the real-world Senegalese status quos relative to the theoretical foundations established in the first two sections.

3.2. An International Tragedy of the Commons.

Fisheries are categorised by both economists and environmentalists as depletable renewable resources. This means that although fish stocks can recover from exploitation, they can also be annihilated to the extent that they will never recover.³⁸ In 2002, it was estimated that as much as 60-70% of the world's fish stocks were being fished to destruction.³⁹ Even the resources required by fish to survive are of limited abundance, and therefore the biology of fisheries is such that fish numbers will increase at a positive rate until a threshold population has been reached, but thereafter the population grows at a decreasing rate until eventually equilibrium is achieved and population growth equals the mortality rate.⁴⁰ This means that if controlled effectively commercial fishing may take place in a truly sustainable manner as long as catches are restricted to a level where the population can fully recover from harvesting.

Problematically, the logic which underpins arguments for restricting fishing to that level where a biological equilibrium is maintained is fundamentally at odds with the logic behind the tragedy of the commons dilemmas. Since Garrett Hardin first published his challenging article titled '*The Tragedy of the Commons*' in 1968, the phrase has come to symbolise the degradation of commonly shared resources.⁴¹ Hardin's paper suggests that the benefits received for shared resources are appreciated individually, while the costs associated with the degradation of the resource are shared between users. Hence in a commonly shared pasture the rational herder will be compelled to graze extra livestock to her own benefit, but to the detriment of her colleagues.

Therein is the tragedy: Each man [sic] is locked into a system that compels him to in-

38 Titanberg, T. (1992) *Environmental and natural resource economics*. 3rd ed. New York, Harper Willins, p 304.

39 Brown, P. (2002). Op cit, p1.

40 Kahn. (1995) *The economic approach to environmental and natural resources*. Orlando, Harcourt Brace, p 269.

41 Ostrom, E. (1990) *Governing the commons*. Cambridge University Press, Cambridge, p 2.

crease his herd without limit – in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interests in a society that believes in the freedom of the commons.⁴²

Certainly Hardin was not the first to notice the status quo of the tragedy of the commons, but his thinking has been profoundly important for understanding the nature of the individualistic tragedy of the commons, especially when formalised as a prisoner's dilemma game. In her publication of 1990, Elinor Ostrom artfully describes both Hardin's individualistic tragedy of the commons problem as well as Mancur Olson's insightful views on the free rider problems associated with attempting to achieve collective action, published in his 1965 book *The logic of collective action*. Indeed both of these theories have influenced thinking on issues of common pool resource use profoundly, though Ostrom's important and different take on the matter has been perhaps one of the most exciting developments in the field in recent times. Searching for a new view on the issues surrounding common pool resource utilisation Ostrom holds:

As long as individuals are viewed as prisoners, policy prescription will address this metaphor. I would rather address the question of how to enhance the capabilities of those involved to change the constraining rules of the game to lead to outcomes other than remorseless tragedies.⁴³

Before I describe Elinor Ostrom's approach to common pool resources, I shall do as she has done and provide an understanding of the thinking behind the philosophies of Hardin and Olson.

Summarising Hardin's view on tragedies of the commons is perhaps best done by way of a simple prisoners' dilemma game. Suppose for the sake of argument, the players in this game are rational participants in the exploitation of a fishery resource with a limited capacity to yield benefits to fishers. This upper limit can be denoted by the maximum number of boats, which can be sustained by the fishery. This number can be denoted as B . In a game comprised of two fishers, the 'cooperative' strategy can be interpreted as each fisher using $B/2$ boats, or $B/2$ boats for the entire fishery and a profit of 10 units for each fisher. The 'defect' strategy on the other hand is for each fisher to use as many boats as she feels that she can use while still making a profit from her fishing activities. In this case both fishers will suffer a relative loss proportionate to the extent of the over-fishing. If fisher G limits her capacity to $B/2$ while fisher H uses $B/2 + X$ boats,

42 Hardin, G. (1968) *Tragedy of the commons*. p 1. in *Science*, vol 1, pp 1243-8

43 Ostrom, E. (1990) *Op cit*, p 7.

the defector (H) obtains a surplus profit of $10 + Y - Z/2$ units, to the detriment of the other (G) who obtains $10 - Z/2$ units, as they share the costs of the misuse of the resource. Problematically in the absence of a binding contract, the dominant strategy for each player is to defect. Ironically when both players opt for the defect strategy, the outcome is the Pareto inferior, or undesirable for both players. Ostrom notes the paradox contained implicitly within this game as well as other prisoners' dilemma games, where the preferred outcome for each player is achieved through the cooperative strategy. Paradoxically rational choice in the absence of communication between players insists that they both defect, thus yielding a Pareto inferior outcome by way of an outcome that is in effect the preferred choice of neither player.⁴⁴ This logic is at the heart of Hardin's observations as well as the enormous challenges associated with attempting to regulate fisheries and other shared resources.

Mankur Olson's argument is closely related to that of Hardin, though his work has been done in the field of the logic of collective action. He suggests that an individual who cannot be excluded from the benefits of a collective good has little incentive to voluntarily work to provide that good.⁴⁵ Hence emerges the paradoxical problem of the free rider where rational choice may dictate that nobody work to provide a collective good, with the result that there is no collective good to be shared at all.⁴⁶ Relating this view to fishery dilemmas shows that fishers are less inclined to contribute to the regulation of the resource, than they are to free ride off of the regulatory efforts of other fishers, thus producing another outcome that is the preferred choice of none of the participants, as nobody feels compelled to regulate the resource use.

Ostrom has argued that it is the premises contained within these two theories apropos common pool resource use and effort sharing that has led to centralised government control of natural resources as being the predominant method for regulating the exploitation of natural or common property resources. "The presumption that an external leviathan is necessary to avoid tragedies of the commons leads to recommendation that central governments control most natural resource systems."⁴⁷ In a similar way the author notes that privatisation has been hailed as a

⁴⁴ Ibid, p 5.

⁴⁵ Ibid, p 7.

⁴⁶ Olson, M. (1971) *The logic of collective action: public goods and the theory of groups*. Cambridge, Mass. Harvard University Press, p 2.

⁴⁷ Ostrom, E. (1990) Op Cit, p 9.

means to eradicating tragedies of the commons by ascribing private property rights to user groups of various resources. In this case the onus of control and regulation falls upon those who own the resource. Problematically such a system of ownership may not always be efficient or possible. In the case of terrestrial resources, the division of land may not only be costly to effect and enforce, but it also increases user's risks of suffering great losses associated with uncertain environmental conditions. On the other hand, in the case of water resources it is still unclear as to what the establishment of private property rights even means.⁴⁸ One of the key premises of Ostrom's work has been to look beyond the rivalistic logics behind the two above-mentioned approaches and to seek out a more co-operative approach to common property resource use in the absence of often inefficient centralised systems of control. The author suggests that the challenging problems accompanying the regulation of shared resources may be overcome by way of a binding contract between herders (users) committing themselves to a cooperative strategy that they themselves will figure out. Thus:

the herders, who use the same meadow year after year, have detailed and relatively accurate information about the carrying capacity. They observe the behaviour of other herders and have an incentive to report contractual infractions. Arbitrators may not need to hire monitors to observe the activities of the contracting parties. The self-interest of those who negotiated the contract will lead them to monitor each other and to report observed infractions so that the contract is enforced. A regulatory agency, on the other hand, always needs to hire its own monitors. The regulatory agency then faces the principal-agent problem of how to ensure that its monitors do their own job.⁴⁹

For Elinor Ostrom this approach to resource management avoids many of the problems that are characteristic of centralised private ownership or government control, and indeed appears to offer a chance at a more efficient system of regulation through the nurturing of cooperative relationships between users.

An important question for this research is whether it is conceivable to achieve the efficient regulation of ocean fishery given the present constraints within the international system. It is important to acknowledge that 99% of fisheries are privately owned by the states with jurisdiction over the water within which the fisheries exist. This comes as the result of the 1970 United Nations (UN) Law of the Sea conference which led to the 1982 convention giving coastal states a

⁴⁸ Ibid, p 13.

⁴⁹ Ibid, p 21.

200-mile economic jurisdiction over all of the ocean which parallels their borders.⁵⁰

Although this resolution was no doubt reached with a view to providing a legitimate framework for regulating the use of oceanic resources, for the developing state with little or no means to effect costly regulation and enforcement procedures, the advent of the 200-mile limit appears to be exacerbating fishery management problems rather than solving them. This worsening situation comes as the result of the absence of Ostrom type self-regulation but in the presence of the Hardin/Olson type impetus to exploit a poorly controlled resource. A comfortable niche for the pirate fisher has thus been created, not in a fishery policy vacuum, but in a monitoring and enforcement one. This has surely resulted from the fact that although at an international level property rights have been assigned for most of the globe's ocean fisheries, the nature of poorly regulated fisheries remain common property in the sense that almost any fisher with the right hardware can extract benefits from the resource without being sanctioned. Hence the international fishery status quo is such that approximately two thirds of ocean fisheries are on the brink of collapse, while some of the only healthy fish populations exist in territories where funds have been available to enforce state controls and individual property rights. Given the constraints associated with the imposition of international property rights apropos oceanic resources within the 200 mile economic zone, this research seeks to marry the role of the free market with rigid policy controls intended to limit the quantities of fish harvested from a given fishery. Although indeed, as Elinor Ostrom may argue, this approach may not be the ideal, at the international level it appears to be one of the most realistic approaches for the time being, given the already entrenched institutional arrangements. Considering that the world's fish populations are in crisis, the urgency of the situation prescribes as hasty a remedy as is possible, and not a long and complicated process of institutional change from the bottom up. Perhaps this latter challenge may be left to latter generations who are operating under less urgent circumstances. Thus for the purposes of this research it becomes necessary to outline some of the economic thinkings behind controlling fishery utilisation.

The practical ramifications of the fact that in truth oceanic fish resources are subject to property rights prescribes that creative attempts at fishery management must be made within the bounds

⁵⁰ Simmons, I.G. (1991) *Op cit*, p 113.

set by this modality. This appears to make the possibility for complete privatisation or self-management by user groups an unlikely scenario, at least at the international level. Thus the real work to be done in a practical sense is to organise relevant institutions in such a way as make them operate at maximum efficiency. On the challenge of fine-tuning these institutions, Ostrom notes:

It is a process that requires reliable information about time and place variables as well as a broad repertoire of culturally accepted rules. New institutional arrangements do not work in the field as they do in abstract models unless the models are well specified and empirically valid and the participants in a field setting understand how to make the rules work.⁵¹

Although many fish stocks are migratory, this analysis of fish resources will still be made in terms of private ownership because, ultimately, what is at issue here is the illegal misappropriation of fish within the territory of sovereign states. Hence, the costly regulation of fisheries by the states that own them provides a legally feasible means of curbing pirate fishing. In cases where the costs of such policy enforcement are greater than the impetus for invoking protective procedures one is required to either boost impetus or find a way of meeting costs. This study seeks to do both. First through providing a method for estimating the economic costs associated with pirate fishing; and second through providing a framework for recovering funds from the industry itself for the regulation of the industry while recognising the need to constantly enhance and fine tune the quality of those regulatory institutions. Importantly, and as shall become clearer later, in order to enhance the quality and effectiveness of regulatory institutions, inefficiencies such as those created by IUU fishing must be eradicated. This forms much of the justification for this research, which aims to provide a means to eradicating this costly source of inefficiency.

One may well inquire as to why it is that fishery resources, particularly in a country like Senegal that depends heavily upon those resources, might be managed in an inappropriate or incomprehensive way. Political theorists such as Jan Kooiman might argue that although the solutions to environmental rights issues are frequently viewed by both the public and the private sector as requiring intervention on the part of government, it is frequently the case that government effec-

⁵¹ Ibid, p 14

tiveness with regard to such responsibilities is low.⁵² The author suggests that there may be several reasons for this. Kooiman argues that frequently environmental policy failures are the product of bureaucratic inefficiencies and the inability of market measures to yield effective results. Furthermore, the author asserts that public sector effectiveness with regard to environmental policy issues normally lags behind the social and political expectations of its critics. This time lag may be due to a variety of reasons including the obstruction of state power by large and powerful institutions.⁵³ Nicholas Low, on the other hand, argues that it is not so much planning, as it is the idiosyncrasies of political processes that determine the nature of policy outcomes.⁵⁴ Hence good governance, particularly with regard to environmental and natural resource rights dilemmas, must be viewed as a process of learning, and fine tuning of institutional arrangements rather than a static and strictly outcome based political process.⁵⁵ These views are of immense importance when considering the apparent policy failures on the part of the Senegalese government with respect to the management of their ocean fishery. This research is therefore orientated by the desire to examine ways of improving and fine tuning Senegal's fishery management policies.

3.3. Economic Perspectives on Fishery Regulation.

Senegalese authorities state that in 1978 the small scale or artisanal fishing industry in Senegal produced 49 000 tons of fish whereas in 1999 only 10 000 tons were produced by the same sector. The Wise Coastal Practices for Sustainable Human Development Forum (WCPSHDF) in Senegal suggest that this alarming decrease has been caused by the economic mismanagement of the fishery.⁵⁶ One of the key issues for fishery economics is that there exists an apparent cleavage between the biology of fisheries and the economic considerations pertaining to their harvesting. Many of the techniques for regulating fisheries attempt to implement biologically sustainable levels of harvest by restricting catch levels through policies based largely upon economic principles. However, these measures are frequently criticised for being insufficiently in tune with the biological equilibriums required by various fish populations for yielding a biologi-

52 van Vliet, M. (1993) *Environmental regulation of the Business*. In Kooiman, J. (1993) *Modern governance*. London, Sage Publications, p 105.

53 Ibid.

54 Low, N. (1991) *Planning, politics and the state*. London, Unwin Hyman, p 10.

55 Kooiman, J. (1993) Op cit, p 107.

56 *Combining traditional and modern practices in fisheries / Sine-Saloum-Senegal*. (1999) www.csiwisepactices.org

cally sustainable fishing regime. Unfortunately the difficulties experienced with attempts to achieve supply side regulation form only one part of the greater challenge of achieving sustainable use of these precious resources.

Viewed at a macro economic level, the predominance of global free trade appears to be worsening the situation for fisheries by inhibiting demand side controls which might be used to back up supply side regulations such as Open-Access and Limited-Access restrictions. Nowadays the prevalence of free trade arrangements seems to be an unavoidable characteristic of the global economics of trade. There are, however, those theorists who hold the view that liberal economic modalities may hold the solution to problems of resource depletion. The view advanced by the advocates of 'free-market environmentalism' challenge the fundamental notion that there exists significant incongruence between neo-liberal economic logic and environmental prudence. Here again, problems such as the 'Tragedy of the Commons' are viewed as being the affect of poorly defined property rights and inappropriate pricing mechanisms. According to this view the role of the market should be extended through employing price incentives and disincentives for regulating environmental resource use, rather than retarded by rigid policy controls.⁵⁷

The Hecksher Olin theory of comparative advantage states that every country exports those goods that use abundant and affordable factors of production.⁵⁸ Hence, according to this model, trade liberalisation plays an emancipatory role for some states as each country exports those goods in which it has a comparative advantage at producing. International trade becomes a matrix of exchanges between parties wishing to exchange goods, which are easy for them to produce in return for goods that are comparatively more difficult for them to produce. The great spin off effect of this thinking is to make international trade somewhat equitable between unequal partners. However, issues have become a little more complex in the real world where factors of production are shared between states. The fishery is a prime example of this, where the natural resource base may rest in one country, while much of the capital equipment used to extract the resource comes from another. In this case the comparative advantage depends upon both the property rights and the nature of the regulation apropos the use of the resource. Sup-

57 Anderson, T.L. & Legal, R.L. (1991) *Free market environmentalism*. San Fransisco, Pacific research institute for Public Policy, p 21.

58 Williamson, J. A. (2000) *Globalization and inequality, past and present*. In Frieden, J & Lake, D. (2000) *Interna-*

posing that there exists zero, or only poorly defined property rights over the resource, the foreign fishing company with a comparative abundance in capital equipment for the production of fish products will be able to harvest fish with relative ease, and at relatively little cost. On the other hand if property rights are well defined but there is no regulatory infrastructure to support those privileges, foreign capital-intensive companies may still be capable of extracting rents from the harvest of fish resources with relative ease, and at relatively little cost. In another scenario though, supposing that property rights are well defined and regulatory infrastructures are effective, the comparative advantage in the production of fish products would depend upon the nature of the regulatory framework. If property rights are assigned by way of a quota or licensing system, then regulatory authorities become empowered to increase the costs of production for the capital intensive companies by forcing them to pay a particular sum of money in return for the opportunity to exploit the natural resource. This measure has the effect of immediately lowering the capital-intensive industry's comparative advantage in the production of fish resources, and serving to level the playing field between highly efficient foreign enterprises, and perhaps less efficient but geographically advantaged local industries.

In essence then regulation and property rights give the owners of the resource a valuable opportunity to manipulate the comparative advantages contained within an industry. By effecting various licensing and other restrictions, modes of production can be modified in order to yield a greater comparative advantage in the production of fish products for local fishers. Consequently it may be useful to investigate some of the common means of regulating natural resource and fishery usage.

Economic fishery management techniques are typically supply side regulations, which require accurate estimates of the value of fishery resources. It is thus important to be able to calculate the value of these resources in order to establish appropriate enforcement costs. Pearce and Turner suggest that the economic value of an environmental resource can be represented by the following equation: Total Economic Value = Actual Use Value + Option Value + Existence Value.⁵⁹ Actual use value denotes the value of the benefits enjoyed by those who use the resource directly. Option value includes: 1. The willingness to pay to preserve the resource for

tional political economy. London, Routledge, p 407.

exploitation in the future; 2. The pleasure in knowing that others derive value from the resource; and 3. The will to preserve the resource for future generations. Finally existence value acknowledges the welfare of nonhuman beings.⁶⁰ Indeed this equation appears to lack credibility in the light of the problematic task of applying such qualitative variables as 'option value' and 'existence value' to a necessarily more rigid quantitative process of economic valuation of natural resources. Furthermore, it may be unnecessary to establish the option value and existence value of a resource if it is possible to ensure its future well-being without doing so. Hence it appears as if 'actual use value' may be an important first port of call for valuing a resource for the purpose of establishing effective regulatory policies. In counter point though, James Connelly and Graham Smith argue that economic methods for evaluating the value of natural resources are inappropriately over simplified. "Simplification leads to misrepresentation. Political conflict is reduced to questions of aggregating preference intensities."⁶¹ For the likes of Connelly and Smith, and Jonathan Aldred, economic valuation techniques are too simple to produce values which are appropriately inclusive of all relevant considerations. The rationale behind this position suggests that the worth of environmental resources is not restricted to simple economic interpretations of their value.⁶² Hence such models are oversimplifications of the multifaceted value of natural goods. Economic techniques are simply unable to fully account for the intrinsic and inherent values of these resources in this view. Furthermore estimations such as actual use value cannot account for the value of resources that are not in use, or as yet have no significant demand or direct utility to humans. This is despite the potential future usefulness of these resources.⁶³ In spite of these considerations, it is arguable that economic valuation methods based upon the actual use value of fishery resources may provide a valuation technique which is capable of providing the basis for more efficient fishery regulation, at least in the short to middle term. This is largely owing to both the difficulty associated with assigning monetary values to the inherent and intrinsic values of natural resources, and the belief that appropriate policies, informed by actual use value estimations, can yield the model for a biologically and economically sustainable international fishing regime. Most importantly though, the fish resources being

59 Pearce, D. and Turner, R. (1999) in Connelly, J. & Smith, G. (1999) Op cit, p 144.

60 Loc cit.

61 Ibid, p 144.

62 Aldred, J. (1999) *Existence value, moral commitments and in-kind valuation*. in Foster, J. (1999) *Valuing Nature*. London, Routledge, p 233.

63 Uzodike, N.O. (2003) Personal communication. July, Pietermaritzburg.

investigated here are ones for which it is possible to assign an actual use value based on the monetary or market value of the resource. It is unlikely to be the case that fish resources which are of no actual use value will be harvested by fishers in any great numbers, this is of course to exclude the problem of incidental catch which shall be touched on later.

Although these somewhat abstract considerations form the basis for the development of a better way to fish, it is crucial to understand the finer workings of the fishery and its use. Colin Clark makes a strong argument for the regulation of fisheries through his clear explanation of the economic life cycle of the unregulated open access fishery. Clark shows that unregulated fisheries are inclined to reach a 'bionomic' equilibrium, where revenues earned from fishing are equal to the opportunity cost of the activity. At this point the economic rents are almost completely depleted, and fish stocks are devastated.⁶⁴ This view is supported by Simmons⁶⁵ and is commonly held in much of the fisheries literature, thus the 'boom-and-bust' cycle has become distinctly typical of the biology of a fishery where the initial profits from harvest far exceed those appreciated during the sustainable yield phase.⁶⁶ Heavy industrial overcapitalisation is apparently typical of the first phases of fishing in a new fishery, and unless the excess fishing capacity is removed once the initial reduction of the population is complete, severe over fishing is probable.⁶⁷ This can be shown by way of a simple figure. In figure 1.1 below the population growth rate is represented as the dependent variable on the vertical (y) axis, while population is represented as an independent variable on the horizontal (x) axis. K shows the population equilibrium of an unexploited fishery, where the mortality rate equals the birth rate, and population growth is static. This model, which was first developed by Schaefer, is based upon an analysis of a long-term average relationship between population size and population growth rates for fisheries.⁶⁸ The graph is parabolic in nature because of the diminishing marginal returns to population growth associated with the size of the population. In other words, as the population size increases beyond a threshold point the population growth rate begins to decrease until population growth is static. Applying this logic to fishing practices has two key ramifications, the first of which is to

64 Clark, C.W. *Renewable resources: fisheries*. in van den Bergh, J. (1999) *Handbook of environmental and resource economics*. Northampton, Edward Elgar, p 109.

65 Simmons, I.G. (1991) *Earth, air and water*. New York, Routledge, p 112.

66 Clark, C.W. (1999) *Op cit*, p 119.

67 *Ibid*.

68 M. D. Schaefer. (1957) *Some considerations of population dynamics and economics in relation to the manage-*

show that over fishing can lead to the eventual collapse of a fish population, while the other is to show that exploited at a constant and suitable rate, fishing may occur at a level which allows the fish population growth rate to equal the quantity of fish removed, thus providing the basis for sustainable fishing. Figure 1.1 below shows the effects of fishing on an initially unexploited fish population, represented by K. Note that both *catch* and *growth* are measured in biomass units and can therefore be expressed on the vertical axis of the graph. Point MSY represents the equilibrium position where catch and population growth rates are equal and fishing activity is sustainable. Importantly, any harvest level higher than this represents a harvest rate which is greater than the fish population's ability to regenerate itself. C1 represents such an unsustainable catch level where the catch rate outstrips the population growth rate and thus the ability of the population to recover from exploitation. The fish population now experiences no natural growth as humans are removing a portion of the population which is equal to or greater than the fish population's ability to regenerate itself at this level. As the catch rate increases beyond the population growth rate, the fish population will begin to decline steadily and exponentially. The population will fall to X2 where the population size will continue to fall, but at an increasing rate, as the rate of harvest is now much greater than a population size of X2 can support. In other words the harvest level of C1 removes more fish than the population can replace by natural means, shown by C2, with the result that the population size continues to fall.⁶⁹

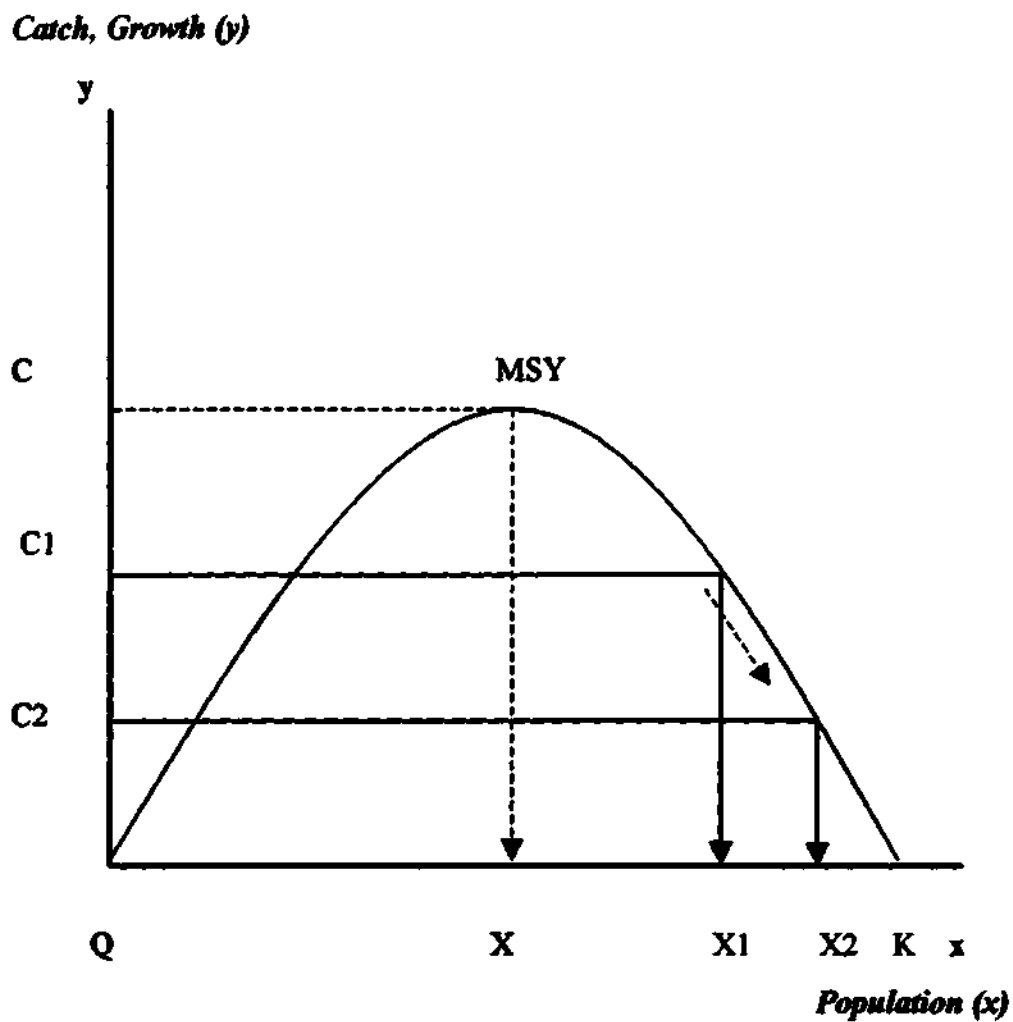
As has already been noted, fish populations not only have the capacity to regenerate themselves, but also to be harvested in a sustainable way. In figure 1.2 below every harvest level except Cmsy has two equilibrium populations.

At C1 the population growth rate is exactly equal to the catch rate, and that the population sizes will remain unchanged for a catch rate of C1 at either of the two population points X1' or X1". Hence this point or catch rate becomes the sustainable or equilibrium catch rate for both population levels X1' and X1". This concept is known as the sustainable yield (SY) function, and becomes highly relevant for calculating a sustainable rate of harvest for oceanic fisheries. Importantly, point Cmsy represents the maximum sustainable yield (MSY), as there is no population size that can produce above this level of harvest. The concept of MSY is also critical for

ment of marine fisheries. Journal of the Fisheries Research Board of Canada. Vol. 14, pp 669-681.

efforts to maximise economic rent gains from fishing in a sustainable manner.⁷⁰

Figure 1.1 Harvest and fish population growth rates.



(From Khan, J. (1995). p 172)

⁶⁹ Khan, J. (1995) Op cit. p 272.

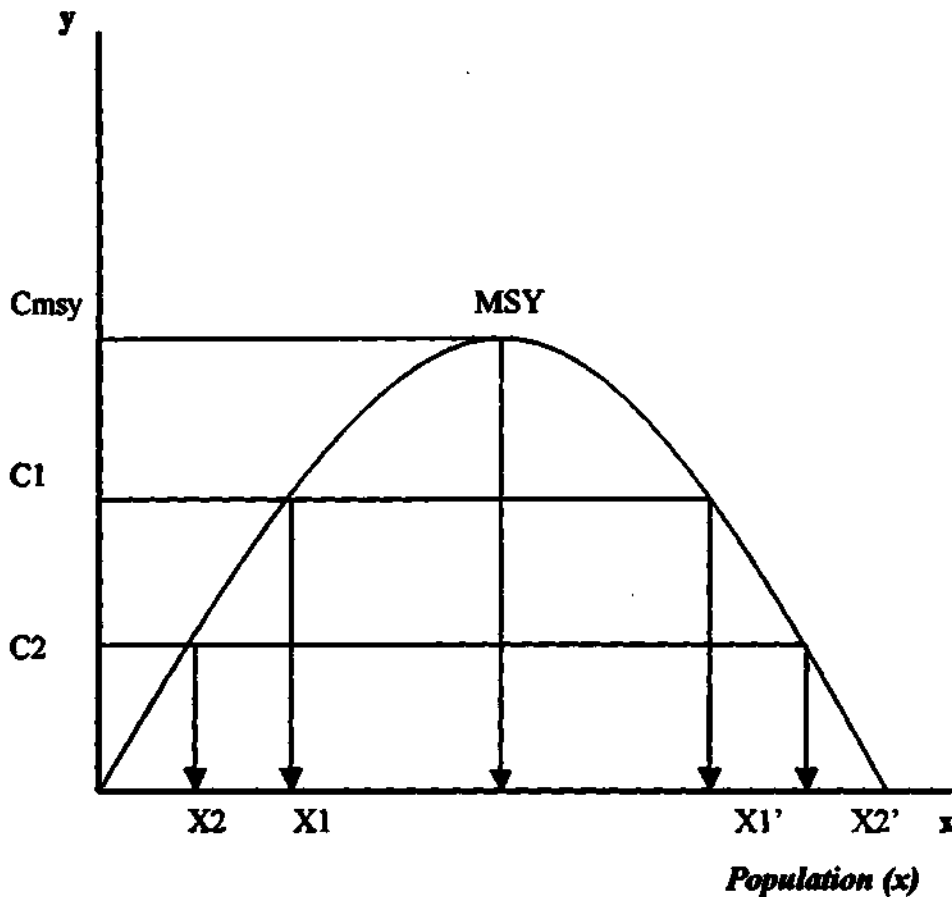
⁷⁰ Ibid.

Figure 1.2

Maximum Sustainable Yield and Equilibrium

Catch functions for a fishery.

Catch, Growth (y)



(From Khan, J. (1995). p 173)

The logic behind the tragedies of the commons dictates that in general fishers will fish above the MSY level for a given fishery in attempts to maximise economic rent gains. This modality operates not only against the well-being of future generations of fishers, but also to the detriment of fish populations. An impetus is thus created for the formation of mechanisms designed to regulate the rent seeking behaviour of fishers. Kahn suggests that the best way to manage fisheries is by affecting a significant opportunity cost of fishing. This is done in two ways. The first, known as Open-Access regulations, increase the cost of fishing by placing restrictions on the numbers and type of fish caught, the methods used, and the areas fished. Such regulations outlaw highly lucrative indiscriminate fishing, thus increasing the cost of fishing, and squeezing out competing

fishers until only the optimum number of fishers remain. The second method involves charging tariffs on fishing licences, and limiting the number of licences available. This technique is known as Limited-Entry and is favoured by economists as simultaneous to increasing costs of fishing, revenue which is earned from the sale of licences can be used to the welfare of the local economy.⁷¹ The latter method is currently being employed in parts of western Africa where limited numbers of licences are sold to fishing companies. However, such fishery regulation is especially difficult to enforce. "Coastlines are typically long and rugged; it is not difficult for fishermen to avoid detection if they are exceeding their limits or catching species illegally."⁷²

Thus: "Policies should be designed to make compliance as inexpensive as possible. Regulations which impose very high costs are more likely to be disobeyed than regulations that impose cost in proportion to the purpose."⁷³ Therefore, as Tietenberg asserts, regulations should also be able to deal with non-compliance. Although a common approach is to sanction transgressors monetarily, the level of these sanctions for non-compliance must be in line with the costs of compliance.⁷⁴ Otherwise non-compliance may become profitable. John Kahn's perspectives concerning fishery management as subject to either open access or limited entry control is echoed in many other economic texts. The optimistic implication here is that fisheries can be rehabilitated beyond the initial 'boom' phase, as long as effective regulation is achieved. This model ostensibly applies to the case of the West African fishery, which is evidently enslaved to the initial phases of this model.

Although Kahn has advocated regulating fisheries through open access and limited entry restrictions in order to avoid the rigours of a 'boom-and-bust' cycle, he also suggests that effective fishery management requires consideration of some factors that transcend the optimal level of catch and effort which is so characteristic of most fishery economics literature.⁷⁵ These considerations concern: the incidental catch of other fish species and marine animals; the pollution of fishery habitats; conflicts between user groups such as commercial and artisan fishers; and inter-

71 Connely, J & Smith, G. (2000). Op cit, pp 287-300

72 Tietenberg, T. (1992). *Environmental and natural resource economics*, 2nd Ed. New York, HarperCollins Inc, p 136.

73 Ibid.

74 Ibid.

75 Kahn, J.R. (1998) *The economic approach to environmental and natural resources*. Orlando, Dryden Press, p 314.

national cooperation regarding the harvesting of migratory species.⁷⁶ This research recognises Kahn's worries, and aims to address the political and economic considerations concerning the latter two. However, in order to fully appreciate the possibilities for achieving such finite goals, it may be useful to interrogate the problem at a macro level.

An important determinant of regulation costs for a fishery may be derived from the 'reservation price' of individual producers' production functions. The reservation price represents the amount that is necessary to compensate a producer for smaller future outputs or catches.⁷⁷

Hence the reservation price is an illustration of the future value of fish caught today. Using this pricing mechanism may be instructive in assessing the value of fish stocks for purposes of setting regulatory catch thresholds. There are five important determinants of the reservation price on fish catches. 1. The interest rate is relevant because if the interest rate is low, the revenue from the sale of fish today is small and the incentive to harvest is smaller than when the interest rate is high. Yet when the interest rate is high, *ceteris paribus* (all other things being equal), the reservation price is low because the incentive to withhold fish from the market is small. 2. The expected future price of the resource is important because if the expected future price is high, then the reservation price is likely to be high, and producers will be more inclined to harvest later rather than sooner. 3. The expected future costs of fishing are relevant because if these costs are high *ceteris paribus* the reservation price on fishing will be small. Producers therefore have less incentive to withhold fish from the market today. 4. The carrying capacity and maximum sustainable yield for the fishery are also important because if fishing practices are reducing the fish population size significantly, then the reservation price will be large. Expected future revenue from fishing will be small due to the depletion of the resource. 5. The last important determinant of the reservation price of a fishery is the potential for the rehabilitation of the population. However the potential for rehabilitative practices to be economically feasible depends on the other four considerations. Thus although the determinants of reservation prices may be extremely difficult to calculate they remain crucial for the efficient exploitation of fisheries, through the inclusion of reservation prices into market prices.⁷⁸ Hence the key to ensuring the conservation of fishery resources is likely to emerge from an effective method for quantify-

⁷⁶ Ibid, p 115.

⁷⁷ Atkinson, L. (1982). *Economics, the science of choice*. New York, Richard Irwin.

⁷⁸ Atkinson, L. (1982). *Op cit*, p 595

ing the determinants of reservation prices, through establishing market prices that include the costs associated with the depletion of the resource. Hence the increase in market price is expected to diminish the quantity of fish demanded,⁷⁹ and thus the quantity of fish removed from the fishery.

Attempts to quantify sustainable yields of fish for particular fisheries have produced concepts such as the MSY (Maximum Sustainable Yield), which denotes the maximum amount of fish which can be removed from a particular fishery in a sustainable way. Simmons shows that this concept is viewed as being fundamentally flawed because of its inability to take into account annual variations in fish stock sizes. A response to this problem has been to develop the concept known as OSY (Optimal Sustainable Yield) which attempts to account for changes in fish populations through combining economic management techniques with the biological constraints that are characteristic of fisheries.⁸⁰ Colin Clark shows how the inception of OSY indicators has had implications for the total allowable annual catch (TAC) for a fishery. Here the fishery is regulated through establishing the TAC and limiting catches accordingly. This is done through tracking the cumulative catch levels for the year, and closing the fishing season as soon as the limit has been reached. Alternatively the length of the fishing season is predetermined according to the capacity of fishing vessels and expected catch rates.⁸¹

Problematically these methods perpetuate competition between fishers leading to catch levels being reached extremely quickly, therefore requiring the fishing season to be shortened. In response to this problem individual transferable quotas (ITQ's) have been developed in order to provide licensed fishers with taxable quotas that can be bought and sold between fishing enterprises.⁸² The results of this technique have been to improve fishing profits among formerly competing fishers, and to ensure that fish resources are available all year round. An alternative to ITQ's has been to impose taxes upon the fisher for landed catches, the effect of which is to tailor catch levels and to provide government with tax revenues. Forecasts of catch levels are necessary for achieving a biological sustainability of the resource. Thus, the tax rate must be set at a level which will inhibit fishing above a particular catch threshold. Problematically this approach requires vast amounts of scarce information pertaining to catch rates and population sizes. Not only does this technique appear to be a blunt instrument for achieving the necessary

79 Parkin, M. (1993) *Economics*, 2nd Ed. Amsterdam, Addison-Wesley, p 71.

80 Simmons, I. (1991) *Op cit*, p 112.

81 Clark, C. (1999) *Op cit*, p 112.

82 *Ibid*, p 113.

appear to be a blunt instrument for achieving the necessary results as a product of the difficulties associated with forecasting, but also the benefits to fishers are extremely uncertain.⁸³ "In contrast, ITQ's can be effective provided only that the management authority has a reasonably accurate model of the biological resource. How to manage a fishery when even this knowledge is lacking is a difficult but important issue."⁸⁴

Fishery regulation is therefore made extremely difficult in the developing world where such information is scarce.⁸⁵ While fishing companies engaging in pirate fishing off parts of West Africa may be taking reservation prices and fluctuating catch levels into account for their own production forecasts, the states with the property rights to these crucial resources are certainly unable to make accurate calculations of their own regarding reservation prices. This is due to the discreet nature of pirate fishing practices, and the fact that the impetus for reform may be lacking as a result of the reality that national income accounting seldom encompasses environmental degradation.⁸⁶ This is probably the result of environmental impacts seldom outlining costs in monetary terms; hence predictions about possible welfare gains and losses associated with policy changes become impossible.⁸⁷ Indeed one of the primary concerns for developing states must be to calculate welfare gains and losses associated with policy change, and to alter policies accordingly. Fishery policies, one would think, might be particularly important to the developing state as the fishing industry provides a sustainable source of food and revenue, both of which are of scarce supply in the political south. Hence the need to find a way to empower states in the ownership of fish resources and to better audit the usage of their fisheries in order to establish effective and affordable controls is enormous. Certainly the eradication of pirate fishing plays a crucial role in this process, as it appears to underpin the meaningfulness of attempting to regulate all other aspects of the fishery, such as determining variables like the MSY, OSY and indeed appropriate prices for ITQ's and tax-based sanctions.

83Ibid, p 114.

84 Ibid.

85 Simmons, I. (1991) Loc cit.

86 Ibid.

87 Garrod, G. & Willis, K. (1999) *Economic valuation of the environment*. Northampton, Edward Elgar, p 364.

3.4. Controlling piracy.

It stands to reason that much of the impetus for addressing the problem of pirate fishing stems from the problem that IUU fishing undermines responsible fishery use. "When such fishing goes unchecked, the whole system upon which fisheries management decisions are based becomes fundamentally flawed."⁸⁸ As Antonio Cervantes argues, this issue creates a special need for research in the field of fisheries administration. Research in this field not only provides better methods for effecting fishery policies in practice, but may also provide important socio-economic insights into fishery dilemmas, thus enhancing understandings of key social and economic issues relating to fishery use, while providing improved technical expertise for expediting needed changes.⁸⁹ However, despite this thinking, the topic of controlling IUU fishing remains relatively new academic territory. What follows in this section are some of the important points of view and perspectives regarding this growing field of study, which are not only informing the development of this academic field of interest, but also international and regional plans of action for ensuring the sustainability of fishery resource utilisation. Importantly much of the literature reviewed in this section deals directly with the phenomenon of IUU fishing and its impacts.

Doulman argues that some of the factors which contribute to the prevalence of IUU fishing are: the existence of excess fleet capacity among fishing companies, the payment of government subsidies for maintaining and improving fleet capacities, high levels of market demand for particular fish products, and ineffective monitoring, control and surveillance of fishing activities.⁹⁰ These comments have been supported in Simon Cripps, Andy Oliver, and Julie Cator's IUU fishing report written for the World Wildlife Fund (WWF), which highlights the same issues as being instrumental in contributing to the prevalence of piracy in fisheries. The authors make special mention of the cleavage between unsustainable fishing on both the high seas as well as within national jurisdiction, thus implicitly supporting arguments for multilateral cooperative approaches to fishery management. The authors also highlight the issue of the subsidisation of the industry by governments as a key contributor to over-fishing where regulations are lax or nonexistent.⁹¹ Kevin Bray outlines some of the processes, which have emerged in response to

88 Doulman, D.(2000). *Events leading to the elaboration of an international plan of action to combat illegal, unreported and unregulated fishing*. www.europa.eu.int, p 2.

89 Cervantes, A.(2000). *The contribution of research to improve fishing control*. www.europa.eu, p 2.

90 Doulman, D. (2000) *Op cit*, p 3.

91 Cripps, S.J. Oliver, A. & Cator, J. (2000). *International aspects of the control and eradication of IUU fishing –*

these dilemmas after the development of an International Plan Of Action (IPOA) for combating IUU fishing. The ambitious preliminary draft was developed in Sydney, and later fine-tuned in Rome in 2000, for adoption by the FAO in February 2001. The Rome draft proposes the following key measures for combating the core problems apropos IUU fishing:

- The more effective implementation of relevant existing international instruments and the ratification or acceptance of, or accession to, such instruments by states that have not yet done so.
- The more effective implementation of flag State responsibility for fisheries conservation and management, including greater transparency in fishing vessel registration systems and records, particularly of the beneficial owners of such vessels.
- The control of "nationals" (natural and legal persons) so as to prevent and deter them engaging in IUU fishing.
- Strengthened port State measures, including the development, bilaterally and multilaterally and within relevant fisheries management organizations, of compatible measures for port state control of fishing vessels, including measures for dealing with suspected infringements of these port State controls by such vessels.
- WTO-consistent multilateral trade-related measures (based on those developed in the International Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the Commission for the Conservation of Southern Blue fin Tuna (CCSBT).
- Improved fisheries databases and information systems, and enhanced data exchange.
- Strengthened regional fisheries bodies.
- The implementation by States of national plans of action to give full effect to the IPOA.
- Improved cooperation between States to combat IUU fishing.
- Assisting developing countries as appropriate to combat IUU fishing.⁹²

Importantly, the realisation of the goals set out in the Rome IPOA requires a combination of legal instruments, enhanced communications and data exchange between international organisations, practical surveillance and control mechanisms, and market incentives in order to address the problem effectively. While the UN Convention on the Law of the Sea's (UNCLOS) provisions relating to the conservation and management of straddling stocks and highly migratory stocks provides a framework for tackling the issues.⁹³

Having viewed the approaches to an IPOA for combating IUU or pirate fishing from a macro level, it may be useful to assess the more micro concerns for the implementation of these macro plans. There exist an array of important and sometimes more practical considerations to be met

an NGO's perspective. www.europa.eu, pp 2-3.
⁹² Bray, K. (2000) *Op cit*, pp 6-7.

if fisheries are to be managed properly. As Kevin Bray argues, with particular relevance to the developing context, and the need for States to manage the fisheries within their national jurisdiction effectively:

Moreover, effective implementation of an IPOA to combat IUU fishing will be impossible if suitable, well trained and adequately rewarded personnel with access to appropriate hardware (boats, aircraft, satellite data, communications systems, computer systems and networks etc) are not available nationally and (when appropriate) regionally to carry out the specific measures in the IPOA. In particular, developing countries have special needs in this regard, for human, technical and physical resources.⁹⁴

Where, in some particular contexts, poachers may be able to move freely between the Exclusive Economic Zones (EEZ's) of neighbouring countries, greater regional co-operation is required.⁹⁵

Unfortunately, developing a plan of action for combating IUU fishing may be one thing, while finding the appropriate mechanisms for bringing such plans into effect is quite another. As so-called 'soft law' instruments, the Code of Conduct for Responsible Fisheries (CCRF) and the IPOA are not required to be formally accepted by governments, as is the case for other fishery instruments such as the 1993 FOA Compliance Agreement and the 1995 UN Fish Stocks Agreement which aim to address problems associated with straddling fish stocks under the 1982 UN law of the sea mandate. However, Doullman argues that despite the soft law nature of these provisions, there is a high degree of moral persuasion, encouraging States to embrace these instruments and oversee their full and effective implementation.⁹⁶ In addition to this moral persuasion for states, there exist regional management of local fish populations. These bodies typically attempt to combat IUU fishing by implementing market controls which try to identify the origin of the fish which have been caught. Port controls, which control landings by regulating and monitoring activities in port, are also used. To date several important regional bodies have been established, and have adopted such measures, including the North East Atlantic Fisheries Commission (NEAFC).⁹⁷ Such bodies may be highly credible and useful as a second tier to combating IUU in those cases where government efforts may lack credibility. Although some states have taken definitive action against IUU fishing, others have not which supports argu-

93 Cripps, S. Oliver, A. & Cator, J. (2000). *Op cit*, p 1.

94 Bray, K. (2000). *Op cit*, p 3.

95 *Ibid*, p 4.

96 Doullman, J. D. (2000). *Op cit*, p 2.

ments for regional fishery bodies. Individual State action includes:

- **Revision of national fisheries and related legislation to close 'loopholes' that permit IUU fishing and related activities to take place.**
- **Implementation of the 1993 FAO Compliance Agreement, the 1995 UN Fish Stocks Agreement and the Code of Conduct for Responsible Fisheries. It has been noted that even where countries have not formally accepted, acceded to or ratified these legally binding instruments, in some instances their provisions have been implemented through policy changes and legislative revision;**
- **Tightened flag state measures to ensure that vessels comply fully with national laws and, where appropriate, agreed regional arrangements, including enhanced national MCS.**
- **Denial of port access to vessels known to have engaged in IUU fishing.**
- **De-registration of vessels where these vessels have been reported or convicted in a court of law for having engaged in IUU fishing.**
- **Closure of markets through the prohibition of landings where fish have been taken outside agreed regional conservation and management arrangements.⁹⁸**

Worthy of consideration is the fact that many efforts to combat IUU fishing, particularly through market mechanisms, have been constrained by an international impetus toward keeping trade open. Thus most anti IUU fishing measures have been tempered by the need to be WTO compliant, while regulation of the market for fish products is urged (but no more than urged) by international bodies who are attempting to foster free trade while realising the need to implement market controls over certain products.

There exist enormous tensions apropos enforcing an IPOA in an international system of sovereign states. Although Cripps, Oliver and Cator suggest that the UNCLOS provides a framework for addressing the legal aspects to managing shared and migratory fishery stocks, the challenges remain severe. As Bray argues:

It has long been accepted that a country cannot be held to be in breach of regional fisheries agreement to which it is not party, even if its vessels fish in a manner that undermines the agreement. As already suggested, however, there is a case for developing new norms of international law in which third party free riding in internationally sensitive fisheries is heavily prescribed. In principle, the UN Fish Stocks Agreement could deal with this issue to some extent. When the agreement is in force, it will be vital to test its provisions against non-members of regional agreements and establish effective operational and legal practice. This will call for effective and timely regional policy cooperation and coordination of MCS arrangements.⁹⁹

⁹⁷ Ibid, p 5.

⁹⁸ Doulman, D. J. (2000). Op cit, p 5.

⁹⁹ Bray, K.(2000). Op cit, p 5.

Despite the clearly imperfect nature of an international legal framework for addressing IUU fishing problems, some success stories have emerged. In a recent report from the Republic of Namibia's Ministry of Fisheries and Marine Resources, Steven Ambabi states that since the establishment of a new fisheries compliance operation in 1992, illegal fishing by foreign vessels within Namibia's EEZ has been reduced to almost zero. The plan, which has been put into effect, involves the deployment of specially trained inspectors to control the off-loadings and transshipment activities of fishing vessels. Inspectors have also been placed on board fishing vessels in order to monitor the activities of these ships while at sea. A fixed-wing aeroplane and patrol vessels have been utilised in order to facilitate inspections and aerial surveillance of fishing activity. Ambabi notes that the exercise is expensive, and that their Ministry is searching for new ways to enforce fishery rules more cost effectively.¹⁰⁰ This case provides a fine example of supply side control, which by all accounts can be highly effective given the necessary thresholds of budgetary liberties. In addition to such supply side successes, there have been some important developments for demand controls on fish products, which do not impinge upon the absolute integrity of an international legal mandate for combating IUU fishing. These developments include a partnership between the World Wildlife Fund (WWF) and Unilever, one of the world's largest buyers of fish, which has led to the establishment of the Marine Stewardship Council (MSC). This association is a non-profit organisation which works to ensure international responsible fisheries management through several mechanisms:

Fisheries applying for certification under the MSC are evaluated in relation to a set of standards that include: sustainability; ecological protection; and legality. The MSC then seeks to create incentives for healthy and legal fisheries. Overall, labelling and thus chain-of-custody control, will lead to increased transparency of the origin of products and so offer the markets and consumers a choice of purchasing legally and sustainably caught fish and products.¹⁰¹

Certainly it is likely that any effective fishery regulation regime will come from a coherent and broad based response. There are cases where demand side responses such as the ones outlined above provide crucial regulatory frameworks, as there are those that rely upon supply side responses and controls. Also important is the need to be able to effect supply side measures as the cornerstone of fishery management but also to prevent complications which may emerge from

100 Ambabi, S.K. (2000). *Presentation on the Namibian fisheries compliance on monitoring, control and surveillance*. www.europa.eu, pp 3-6.

101 Cripps, S.J. Oliver, A. & Cator, J. (2000). *Op cit*, p 5.

inefficiencies in more market based measures.

The Centre of Research for the Development of Intermediary Fishing Technologies (Credetip), a non-government organization set up to protect the rights of artisan fishermen throughout west Africa, argues that the only way to achieve effective fishery regulation off Africa's west coast is to effect a coherent and collaborative response from African coastal states. Such plans require the multilateral adoption of common policies regarding fishing agreements. On 28 May 1999 Senegal and Mauritania signed such an agreement which calls for the following measures:

- The Coordination of surveillance efforts and management of fishery resources between the two states.
- The strengthening of cooperation in scientific research.
- The building of partnerships between professional organisations from within each of the two countries.
- The Authorisation of Mauritanian and Senegalese fishermen to fish in each country's waters.¹⁰²

Commentators on the deal have suggested that although it is a good step towards regional economic integration and protection of fishery resources and local user groups, concern has been expressed over the state's abilities to effectively monitor the use of their fisheries.¹⁰³ This is problematic as reliable monitoring composes a crucial part of effective fishery management, thus the case in question confirms earlier assertions about the imperfect nature of the public policy process when it comes to natural resource management. Indeed the signing of this deal may be an important step in the direction towards a meaningful fishery administration scheme in West Africa; yet inputs from other, non-government stake holders will remain a critical determinant of policy outcomes and effectiveness.

On the other side of the political spectrum come non-government organisations that add their own specific nuances with respect to plans of action against IUU fishing. Recently Greenpeace has offered a three-step solution to the problems associated with pirate fishing, which requires global co-operation. The plan urges states to agree multilaterally to:

- Close their ports to FOC fishing and support vessels.
- Close their markets to fish caught by FOC vessels.
- Close or prevent companies and nationals from owning or operating FOC fishing and

102 Mauritania and Senegal sign a fishing agreement. (1999) www.dakar.com, p 1.

103 Ibid, p 2.

support vessels.¹⁰⁴

Problematically, this plan presents a solution to the problem of pirate fishing without addressing the challenges associated with attempting to find the economic resources, and political will that may be required for its successful implementation, especially in the political South. Hence there remains an enormous need to marry the constraints faced by developing states with the somewhat abstract offerings of international plans of action. Senegalese independent fish-workers authority Ben Yami outlines this tension when he suggested that a good plan for addressing the Senegalese fishery crisis can only emerge from another plan that addresses a complex array of issues such as societal concerns, development issues and the dynamism of fishery ecosystems.¹⁰⁵ In a 1999 publication, *Conversations*, which deals with the issues of international fish workers' rights, the Senegalese author Aliou Sall gives an example of the tuna-centred Senegalese fisheries research as being insufficiently inclusive of the wide array of considerations regarding the different species being harvested in the region. The author argues that if research is to be made truly useful and applicable to a dynamic fishery, it must engender multi-species and multi-scale user group considerations.¹⁰⁶ However, as Ben Yami shows, fisheries issues, especially when dealing with small user groups or less lucrative species, normally attract little interest from big business, hence diminishing the corporate impetus for conducting research and implementing rehabilitative schemes.¹⁰⁷ One may argue that the nature of the cost-benefit analyses used by economists to aggregate net gains and losses associated with fishery usage, and thus inform fisheries policies, are insufficiently in tune with the true costs of the mismanagement of fishery resources. In this case the benefits associated with fishery exploitation are far more easily quantifiable than the costs. This is the case because monetary values can be easily assigned to fishing deals and sold catches while the costs associated with the revenues that may be lost as a result of the destruction of fish resources are significantly more difficult to aggregate. Hence a key challenge for fisheries research is to provide a framework for managing these dynamic, economically significant and politically contentious resources in a sustainable and fair way.

After reviewing recent policy decisions on the part of the Senegalese Ministry of Fisheries and

¹⁰⁴ www.commondreams.org. Loc cit.

¹⁰⁵ *Joining in a bit late*. (2003) Samudra, November 2003, p 36.

¹⁰⁶ Ibid.

¹⁰⁷ Ibid.

Maritime Transport, certain commitments to improving the state of the countries fishery, as well as a certain amount of policy prowess may be identified. There have been two significant developments with regard to such improvements. The first recent development of significance has been the signing of the 1999 agreement between Senegal and Mauritania which incorporates co-operation between the two states in several important policy areas. This agreement allows for the two states to share scientific expertise, certain fishery surveillance equipment, technical information and fishery policy documents.¹⁰⁸ As the fish stocks of the West African region tend to migrate between the territorial waters of the states in the region, fishery regulation problems become regional ones. Agreements such as these between the two neighbouring states, although underdeveloped, are important signifiers of an improving understanding of, and commitment to regional fishery problems such as IUU fishing. The second key development apropos the evolution of fishery policy mandates in West Africa comes as the result of the 2002 accord between Senegal and the EU. In this case the Senegalese Ministry of Fisheries and Maritime Transport refused to sign an agreement with the EU and banned EU fishers from fishing the country's territorial sea until a more environmentally friendly and economically feasible agreement could be reached. Although the agreement which was eventually signed in 2002 mandated no catch restrictions, certain of the terms under the agreement, such as the institution of larger protected areas, biological rest periods for fish stocks and restriction on fishing techniques,¹⁰⁹ illustrate not only improved awareness apropos fishery issues, but also greater savvy on the part of policy players when it comes to attempting to ensure the sustainability of fish resources in the region. Such developments are no doubt important steps in the right direction for the West African fishery, however, in the absence of more highly evolved policy plans and methods for auditing the affects of IUU fishing, the Senegalese fishery cannot be fine tuned from a stand point of improving economic and policy efficiency with respect to fishery resources.

3.5. Summary.

The introduction to this literature review notes four key concerns for fishery authorities in many parts of the Developing World. These concerns relate to insufficient information regarding the state of fish populations, the quantities of fish being removed, the economic value of the fish which are removed, and the parties by whom fish are being taken. Insufficient information

¹⁰⁸ Dakarcom (1999) www.dakarcom.com. Loc cit.

in these regards, combined with the clear impetus and logic behind tragedy of the commons dilemmas, which prompt IUU fishing have a pathological effect on fishery policy. In the absence of this information, there is not only a lack of important knowledge which is necessary for regulating a fishery effectively, but also as a result of incomplete knowledge pertaining to economic prudence behind plans to regulate the fishery, there is very little impetus for implementing policy plans. However, it is clear that both the theoretical and practical hardware exists for effective fishery control. It is also clear that in many cases poor planning and budgetary constraints prevent governments from bringing these hardware into effect.

In essence, what is lacking in the above literature are not methods for regulating fishery resource use, but methods which provide a means for eradicating pirate fishing of migratory fish stocks where no existing structures have been designed for this purpose. There would also appear to be a massive deficit of fisheries literature with respect to the case of Senegal's offshore fishery. This research not only aims to contribute to the existing body of knowledge by applying certain theoretical considerations to the Senegalese case, but also by providing the basis for the implementation of such mechanisms as those which determine the health of the fish population and the monetary value of fish products harvested from migratory fish stocks. Hence the thesis aims at enabling states to set prices for fishing licences that mandate the harvest of decisive quotas, which take into consideration the reservation price of fishing. The point of view which shall be developed in this research will make it possible for states like Senegal to access information regarding the quantities of fish harvested, as well as opening economic space for the introduction of an effective regulatory coast guard authority. Cumulatively, the two tiers of this approach not only make the eradication of pirate fishing and the adoption of effective regulatory policies a realistic enterprise, but also provide the basis for an approach to international trade in fish products which is more favourable to developing countries. By rearranging the modes of control over fisheries, Third World states may become empowered to use their comparative advantages in the production and export of fish products to their own advantage, while fostering a more sustainable fishery regulation regime.

Chapter 4. Senegal's Offshore Fishery: A Case Study.

4.1. Pirate Fishing in Perspective.

On the 20th July 2001 the Senegalese surveillance plane took off on a five-hour mission from nearby Conakry. After a few minutes 32 ships were detected, half of which were big black trawlers without names, flags, or identification. Reports suggest that the 16 unidentifiable ships were pirate fishing vessels, plundering the seas for precious fish and molluscs. Alarming only half of the ships detected on this day were licensed to be fishing in the waters off Senegal's coast.¹¹⁰ It is not surprising then that FENAGIE suggest that not only are Senegalese fishers suffering as a result of IUU fishing in the area depleting fish stocks, but that in the twenty years prior to 2002 an estimated 300 men like Cheik Gueye had lost their lives as a result of collisions with pirate vessels fishing inside restricted zones. (See section 1.1.)¹¹¹ These figures translate to an average of over one dead fisher person per month for twenty years.

Pirate or IUU fishing, defined as illegal unreported and unregulated fishing, by its very nature as an unreported and unregulated fishing activity creates certain problems for policy makers who may attempt to address particular issues pertaining to the streamlining of fishing activity within their jurisdiction. Naturally IUU fishing creates enormous problems when it comes to attempting to audit catch rates for the sake of determining the bionomic thresholds and population health of fish stocks. Any attempt to conduct such streamlining projects certainly faces enormous obstacles in any fishery that is characterised by more than negligible pirate fishing operations. For the purposes of this research, the best one can do to measure the severity of the IUU fishing taking place in Senegal is to assess the reports from local fishers who work in the industry. Although, one may query the relevance of the pirate fishing problem for Senegal in the absence of statistical evidence, the lack of such evidence is itself a symptom of the problem. One must then be compelled to argue once more that the lack of statistics should not be a reason to abandon a research endeavour, but rather one for pursuing it in an attempt to solve such problems and their respective symptoms. This section aims initially to outline fishery regulation dilemmas and the problem of pirate fishing in somewhat simple terms using basic models. Some of the modalities described in these models will then be applied to the policy setting in an attempt to link the abstract concepts of the models to the practical arena of public policy. Later

110 *Pirate fishing plundering the waters of West Africa*. (2001) www.greenpeace.org.

the findings of the first two phases of the section shall be applied to the case of Senegal's off-shore fishery in order to link theory and policy approaches with practice in a more meaningful way.

Having a grasp of the impetus behind the tragedy of the commons and free rider problems allows us to take the next step of outlining how such self-interested rent seeking behaviour affects all players. What follows are some simple games incorporating different changing variables, which are designed to show how various status quos impact upon the circumstances, motives and behaviour of players operating in a fishery. In each figure F denotes fishers A, B and P; Q shows the quantity of fish harvested; SC represents the shared costs associated with the fishing activity; and AC stands for the aggregated costs of fishing behaviour per period.

Game theoretic fishery modalities.

Figure 2.1.

F	A	B
Q	10	10
SC	0	0
AC	= 0	

Figure 2.2.

A	B
Q	10 12
SC	1 1
AC	= 2

Figure 2.3.

A	B
Q	12 12
SC	2 2
AC	= 4

Figure 2.4.

A	B	P
Q	10	10 2
SC	1	1
AC	= 2	

Figure 2.5.

F	A	B	P
Q	12	12	2
SC	3	3	
AC	= 6		

The first dynamic, shown in figure 2.1, is simple and represents equilibrium in a two-fisher fishery with a maximum sustainable yield of 20 units of production. In this scenario both players A and B remove 10 units each without negatively affecting the future well being of the fish population, the future well being of one another, or indeed the well being of future generations of fishers. Harvesting no more than the maximum sustainable yield (*ceteris paribus*) allows fishers

[1] Wilson, J. (2000) *Loc cit*.

to fish without affecting the reservation price negatively, as they ensure future returns to fishing effort through fishing at a biologically sustainable level. Assume that this fishery is characteristic of a perfectly regulated fishery, either by way of government or self-regulation. Note also that the regulation costs are exogenous to these models. Figure 2.2 on the other hand shows a scenario where one of the two legal fishers (in this case B) defects in the absence of perfect regulation. While B achieves a higher rent level through extracting additional fish, he does so at the shared expense of 1 unit to both himself and fisher A, while creating an AC of 2 units. Figure 2.3 illustrates the likely scenario of short-term rent seeking in the absence of perfect regulation where both legal fishers extract additional units at their own, as well as one another's, cost, and an AC of 4 units. The next scenario in figure 2.4 illustrates a fishery where rent seeking behaviour of both legal registered fishers is perfectly regulated, but in the absence of protection against illegal unreported, or pirate fishing. Here pirate fisher P removes 2 units at the shared cost of the registered fishers, and at no cost to herself as a once off pirate with no long-term commitment to the sustainability of the resource. The final case in figure 2.5 shows the fishery in the complete absence of regulation. In this scenario both fishers A and B over fish, and pirate fisher P places additional pressure upon the resource by extracting 2 units above and beyond the extra units removed by the registered fishers, at the shared cost to A and B. Combined the unregulated fishing in this case create an AC of 6 units, and a diminished future reservation price for the resource. This comes as the result of the unsustainable harvesting of fish, and the associated lower returns to fishing effort in future. Although these cases do not include the costs of regulation, it is important to note that an effective pricing mechanism for fish products must be one which includes the costs associated with regulating the resource, and thus the true cost involved in removing fish from fisheries in a sustainable way. In this way the present reservation price for fish products is driven up and fishers are less inclined to over fish in the short term, and more inclined to plan sustainable and longer-term production functions. However, what was intended to be made clear by the figures above is the incentive for achieving effective fishery regulation, as a means to securing the future well being of fishers and fish populations in a world characterised by rational and self interested actors, and imperfect resource controls. This comes as the result of over fishing appearing to be in the best interests of even an honest fisher in the short term, as fishers choose the classical defect defect strategy.

One may now extrapolate a long-term view of the same fishery faced by the same user groups with the same relations between them. If one overlays the the diminishing marginal returns to fishing activity above the MSY level for a fishery (as illustrated in figure 1.1 which shows the relationship between harvest and fish population growth rates) with rational choice games such as the ones above, some disturbing results emerge. Let us assume again that we have three fishers, A, B and P, all of whom fish according to their own interests in the absence of effective regulation. However, in this game the fishers have been overfishing at their own discretion for some time now and the returns to their fishing effort are diminishing. In the first case, shown by figure 2.6 below, all fishers continue to remove the maximum units of fish. Problematically for all fishers an increase in fishing effort fails to yield significant improvements in catch rates as the fish stock has now reached a point of decline where the fish population cannot restore quickly enough the amount of fish removed. Let us suppose that at this new population level a catch rate of 12 units of fish may be removed in a sustainable way. However, the fishers are compelled by greed to increase fishing effort, thus fishing above the MSY for the fishery. Now, as a result of the smaller fish population, maximum effort yields only 8 units of fish for both fishers A and B while pirate fisher P continues to remove 2 units, but at a greater effort co-efficient. Now 18 units of fish are being removed from a fishery that can only sustain a harvest level of 12 units. The shared and aggregate cost to the licensed fishers is now greater than the sum of the excess harvest as their effort co-efficients have increased. Shared costs now equal $-3 + EE$ (Extra Effort) for each fisher, thus leaving aggregate economic costs at $-6 + 2EE$ as all three fishers expend excess resources in dispensing extra units of effort. Note that the excess effort deployed by fisher P has not been added as an economic cost to the licensed fishers, though it may be considered to be an economic loss in a more general way for the fishery as a whole as greater effort yields lower dividends, even for the IUU fisher, thus indicating the unsustainability of the resource. Alarming, if allowed to continue such over-fishing will result in lower and lower catches until the fishery reaches the 'bust' phase where marginal returns to effort are so low that fishing activities are no longer warranted. It is, however, difficult to know at which population and fishing effort level, fish stocks may be salvageable in the presence of the distorting effects of pirate fishing enterprises.

Long-run Game theoretic fishery modality.

Figure 2.6.

F	A.	B.	P.
Q	8	8	2
SC	3+EE	3+EE	
AC	$= 6 + 2EE$		

In short pirate fishers harvest fish at a lower cost compared with other legitimate fishing industries as they incur no costs connected with adhering to open access regulations, nor do they incur licensing costs associated with limited entry controls. The result of such a situation is to enable the pirate fishing practices to provide fish products at an unrealistically low cost to the harvester and therefore the consumer as well. The two approaches to depletable renewable resource management are therefore rendered impotent in the light of pirate fishing, which also makes the estimation of a reservation price for fishing a virtual impossibility. This comes as the result of the questions that pirate fishing raises for the approximation of the third and fifth determinant of the reservation price of fishing. These determinants are the expected future costs of fishing, and the potential for the rehabilitation of the fish population.¹¹² The expected future costs of fishing are unlikely to be calculable without extensive knowledge about the fishery's catch levels, which is information that is made unattainable by pirate fishing. The potential for the rehabilitation of the resource is also made more challenging as a result of the unknown volumes of fish removed from a given fishery by pirate vessels. Impairing the potential for estimating the reservation price of fishing for a particular fishery makes it impossible to quantify the economic value that will be lost to the fishery as a result of over fishing, thus making it unfeasible to set fish prices which represent the long term scarcity of this commodity in the hope of implementing a price-led decrease in the quantity of fish demanded. Although current policy prescriptions in Senegal do not utilise MSY or TAC estimations at present, such figures are certainly important if fisheries are to be regulated in view of ensuring their sustainable usage. Hence the inadequacies of current policies with regard to MSY and TAC estimations should not diminish the integrity of arguments for eradicating IUU fishing in view of making such variables more easily quantifiable. The economic costs of pirate fishing therefore manifest themselves as

¹¹² Atkinson, L. 1982. loc cit.

an unknown set of variables that distort any predictions or estimations intended to inform the appropriate policies for controlling fishery usage. This is not to mention the direct loss incurred through the poaching of valuable fish resources.

4.2. Piracy and Policy Inefficiency.

Formalising policy approaches to environmental concerns inevitably requires policy makers to fulfil a broad range of conditions. Each policy prescription may be constrained by its own set of unique and often bizarre circumstances. The challenges presented for policy makers attempting to provide frameworks for the effective usage of fishery resources is no different. Among the broad range of decisions to be made are some fundamental ones relating to the general goals of a particular policy project, as well as the finer details of attempting to streamline policy efficiency. This section deals with the challenge of fishery policy making in terms of four broad objectives, and three main status quos. A recent plan to improve fishery policies in Senegal noted the three key objectives of the policy process as 1. Secure the sustainability of the resource, 2. Develop the Senegalese fishing sector, and 3. Secure the interests of licensed foreign fleets, namely the EU fleet.¹¹³ However it may be useful to abstract these provisions and expand upon them in view of a longer term, and more sustainable fishery policy regime. Thus the key policy objectives that will be discussed here are: 1. Ensure the long-term sustainability of Senegal's ocean fishery. 2. Secure the impetus for continued regulation and enforcement of policy mandates. 3. Create a policy framework characterised by fair treatment between user groups. 4. Incorporate into the policy framework the capacity for fine tuning, and streamlining the policy structure in future. The two main constraints which will be highlighted apropos this outline are the advent of the 200 mile economic zone mandated by the UN at the international Law of the Sea Conference in 1972, and the the difficulties linked with restricting access to Senegal's ocean fishery resource. Having outlined the general constraints and objectives that will be discussed in terms of a policy approach to the fishery crisis off Africa's west coast, various theoretical views will be taken into account in view of overlaying some policy theory with the practical challenges imposed by illegal fishing practices.

The conceptual basis for developing adequate environmental policy programmes is well illus-

¹¹³ Notes on Senegalese fishery policy. www.SAUP.fisheries.unc.edu, p 1.

trated by Clement Tisdell's description of the importance of such policies for humans. The author notes:

Improved conservation policies can raise human welfare and economic development projects can be more soundly, securely and sustainably based if adequate attention is given to their ecological and environmental implications. Even in the absence of economic growth and the possibility of doom for Mankind, [sic] scope exists for improving environmental conservation strategies so as to raise human welfare by paying attention to economic principles.¹¹⁴

However, given the apparently sound arguments for economic policy approaches to natural resource use, there remains the question of who is to mandate these prescriptions. Although the role of government control over natural resources can be a hotly debated topic, for the purposes of argument this critique has been constrained by the institutionalisation of the 200-mile coastal zone. According to contemporary international convention this step has assigned the responsibility of coastal resource management to the state adjacent to the relevant resources and therefore the government in control of the relevant state. However, effective resource control requires a disciplined approach. One of the paradoxes of resource control is to balance the sometimes almost limitless demand for a resource with absolute benefit.¹¹⁵ Indeed it may seem like good sense, especially to the developing state, to exploit a resource in the short term for the sake of improving a balance of payments, or budget deficit problems. Yet such behaviour is not guaranteed to yield the best overall benefit to society in the long term. Thus effective resource control inevitably requires significant prudence and effective leadership. In the absence of a willingness to manage resources effectively some additional impetus such as international pressure may become necessary. For this reason in some places fishery management and monitoring typically incorporates a broad range of government and non-government actors.¹¹⁶ Here again, optimal resource control not only requires willingness, but also vast information and resources. As Ostrom argues:

The optimal equilibrium achieved through following the advice to centralize control, however, is based upon assumptions concerning the accuracy of information, monitoring capabilities, sanctioning reliability, and zero costs of administration. Without valid and reliable information, a central agency could make several errors, including setting the carrying capacity or the fine too high or too low, sanctioning [users] herders who coop-

114 Tisdell, C. A. (1991) *Economics of environmental conservation*. Amsterdam, Elsevier Science Publishers, p 21.

115 Ibid, p 24.

116 Beatley, T. Brower, D. J. & Schwab, A.K. (1994) *An introduction to coastal zone management*. California, Island Press, p 61.

erate, or not sanctioning defectors.¹¹⁷

Other theorists argue for government control, and private property rights as means to establishing appropriate policy approaches to resource management. According to this thinking the difference between private and public costs of mismanagement must be eradicated either through property rights or government intervention.¹¹⁸ One advantage of assigning property rights is the creation of a market for the right to exploit the resource, this may be useful as a means to valuing a resource in terms of consumer's willingness to pay access to those resources. Hence many economists believe that the most efficient resource use will come from market centred solutions because they provide an alternative method for revealing important information independently of frequently inaccurate government estimates. A mix of government control and property rights may then provide a solution by way of combining the benefits associated with government control and those provided by private property rights. Thus many of the important costs of regulating user group's activities may be accounted for through the sale of property rights, while much of the necessary information can be obtained from users. A crucial benefit of this hybrid approach is to provide for the recovery of lost social welfare through a tax or property rights vending system. While increasing the cost of fishing, and thus provoking a downward shift in supply, or change in the production of fish products to a more endurable level.

Problematically many of the fish resources harvested in Senegal also frequent the waters in adjacent states. This creates several dilemmas. The first and possibly most material complication arising from this situation arises from the tendency of many regulations discriminating against states that implement rigid controls.¹¹⁹ Certainly much of the driving force behind policy reform regarding fisheries is provided by a perceived potential economic gain from the sale of fish resources in a sustainable way. However, as we have already seen the logic of sustainable resource usage is fundamentally at odds with the incentives for over exploitation of resources. Thus some politically contentious issues surround the competition between neighbours for distributional benefits from a shared fishery. The figure below illustrates how rigid policy implementation in one state may work to the detriment of that state in a globally competitive market.

117 Ostrom, E. (1990). *Op cit* p 10.

118 Butler, A. (2000) *Environmental protection and free trade: are they mutually exclusive*. In Frieden, J. & Lake, D. (2000) *International political economy*, 4th Edd. New York, Routledge. p 435.

The figures, 3.1 and 3.2, below feature two countries, country X and country Y. Country X implements policy controls, represented by the shift from initial price and quantity levels P1, Q1 to P2, Q2, while country Y implements no regulations. The result is a downward shift in the supply and demand functions for fish products for country X. Now country X produces less fish at a higher price, while country Y maintains an unchanged production profile, lowering the world price, as shown by equilibrium position P3, Q3 in figure 3.2 and holding a position with the potential to out compete X in the world market for fish products and or fishing licences.

In essence then the effective management of a cross border fishery requires not only policy prescriptions within member states, but between them as well. Not only do the activities of fishers require monitoring, but also those of member states. As Dupont and Phillips suggest: "It is standard wisdom in the fisheries literature that substantial gains in resource rent could be obtained if the fishery could be properly regulated."¹²⁰ However, as the authors argue, in attempting to make policies more efficient, the rationalisation of the industry may contain unforeseen costs. The authors offer an empirical methodology for quantifying the distributional effects of fishery regulation. This research uses this methodology to illustrate that pirate fishing makes it impossible to assess the validity of policy approaches to fishery management bearing upon the broader distributional consequences of those policies.

The empirical methodology offered by Dupont and Phillips has four steps:

- Calculating the potential rent, which could be generated by alternative regulation schemes using empirical estimates of the fish harvesting technology.
- Simulate alternative procedures for distributing rent gains, to tax payers in equal shares or to fishermen.
- Using estimates of the fishing technology and accounting for the state of the labour market, calculate the employment and income losses associated with the regulation proposals. In a low employment world, alternative employment may not be available to displaced fishermen, so job losses will impose serious financial hardships.
- Specify a decision-making criterion (e.g. to maximise the aggregate measure of well-being of the entire population or to treat all affected parties 'fairly') and evaluate the distributional benefits and costs of alternative proposals from the chosen perspective.¹²¹

¹¹⁹ Ibid, p 440.

¹²⁰ Dupont, D. & Phipps, S. (2001) *Distributional consequences of fishery regulations*. [no place] Canadian Economics Association, p 206.

¹²¹ Ibid, p 207.

Figure 3.1. The effect of policy non-compliance
in a two-country environment.

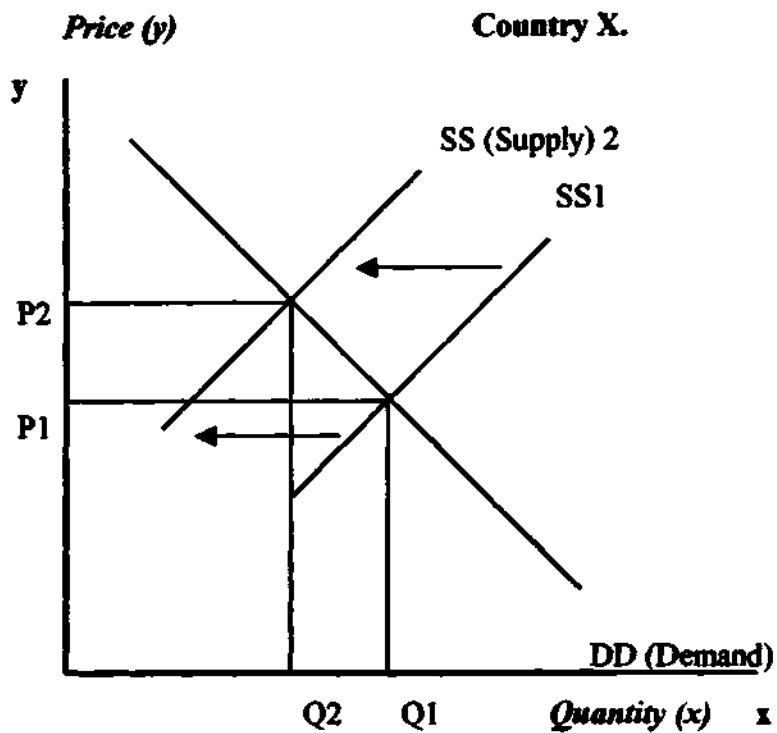
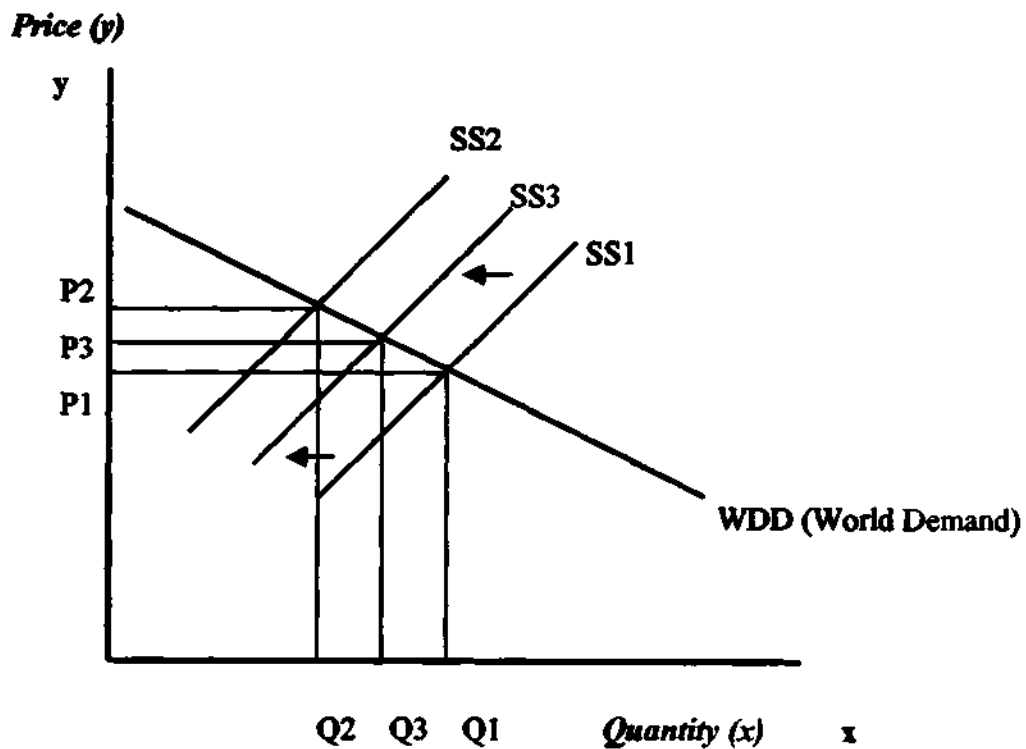


Figure 3.2. Country X & country Y.



(From Frieden, J & Lake, D. (2000). p 440)

Such analyses are of enormous significance to states such as Senegal which depend heavily on fishery resources for worker incomes as well as rent gains associated with the sale of fishing licences to other states. The trade-offs involved in adopting appropriate policy controls are likely not only to have a meaningful effect on the livelihoods of artisan fishermen but also for the economic development possibilities of developing states. However, in states with poorly developed coast guarding infrastructures, the impact of pirate fishing appears to distort estimations regarding policy approaches to fishery regulation.

Applying the advent of pirate fishing to the policy objectives (described above as being pivotal to the sustainability of the Senegalese fishery) further illustrates the need to eradicate this problem if effective fishery administration is to be realised. As an illegal and unreported activity, pirate fishing distorts important information for fishery policy makers, making the capacity for fine-tuning policies almost impossible by creating exogenous and unaccounted for variables for fishery managers. This in turn makes true equity between user groups almost impossible to achieve as fishery information is distorted and estimated MSY levels are perverted, which in turn makes taking stock of harvest rates impossible to estimate accurately, and thus desecrates attempts to ensure the sustainable use of the resource through policy approaches. This is not to mention attempts at streamlining the distributional effects of certain policies.

Hence what is required is a policy approach to the pirated fishery, which eradicates the problem of illegal fishing first and foremost. Thus one is compelled to fulfil the policy objectives set out above bearing on: 1. The fishery as a resource from which it is difficult to exclude users. 2. The property rights over ocean resources assigned to coastal states by the UN law of the sea convention. 3. The potential for a legal system to process international disputes between interested parties.

4.3. Policy Ramifications in Senegal.

There can be little doubt that the fishing industry in Senegal is faced with severe problems accompanying the mismanagement of the country's fish resources. Problematically the exact nature of the fishery management inadequacies in the region is complex. IUU fishing in the wa-

ters in and around Senegal would appear to take several forms, each requiring slightly different policy approaches.¹²² On the one hand we have FOC fishers, whose entire operations are illegitimate as they fish inside the EEZ's of states which have not authorised them to be there. On the other hand we have licensed fishers who may be using illegal methods, fishing inside restricted zones, taking protected species, or exceeding recommended catch and by-catch limits. Although this thesis deals explicitly with the problem of pirate or rather FOC fishing, the solutions to associated problems are only likely to emerge as a result of a broad based strategy for regulating the resource. This comes as the result of the interconnection between licensed fleets as a source for revenue which may be used in part to eradicate FOC fishing, and FOC vessels which have the ability to shift world prices for fish products downwards thus perverting the ability of legitimate fishers to earn the rent required to provide for the regulation of the resource. The problem is complicated further by shared nature of the resource between Senegal and its neighbours, especially Mauritania.

What follows in this section is an outline and critique of the existing agreement between Senegal and the EU. This agreement will be examined in view of outlining the need to streamline the efficiency of these agreements for the purpose of adjusting the prices of fishing licences with the real costs of ensuring the sustainability of fish stocks in the region. Second comes a critique of the fishery agreements between Senegal and Mauritania. Third, an examination of the possibilities for sanctioning FOC vessels as well as licensed ones engaging in IUU fishing will be used to inform a framework for a more efficient management scheme. Fourth, and lastly, the author intends to show that despite the theoretical accessibility of excellent fisheries policies, there exist some profound political obstacles to implementing such plans, which may even reflect some of the current policy inadequacies apropos fisheries in the region.

Despite a stated commitment to the sustainable usage of the West African fishery on the part of the European Union, who do the bulk of the fishing in the area, problems connected with poor regulatory measures in the area appear to be contributing to the systematic depletion of this precious resource. To begin with a recent study on the Mauritanian fishery shows that the amounts owed to Mauritania by the EU for use of their fish resources are simply subtracted from the

122 Uzodike, N.O. (2004) Personal communication. Pietermaritzburg.

country's debt repayments to the EU.¹²³ This would seem to diminish the state's real appreciation of the value of their fish as fees may be poorly adjusted and information of market values for fish products difficult to attain. Another study, which examines the existing deals between the EU, Senegal and Mauritania respectively, makes some telling observations. The latest deal between Senegal and the EU covers the four year period between July 2002 and June 2006, and allows approximately 125 vessels access to Senegalese waters at an average cost to the EU of € 128 000 per vessel. The total EU budget is € 64 million with 19 per cent having been earmarked for supporting measures such as monitoring resources, inspection, safety, support for small-scale fisheries and auditing of partnership schemes such as the one between Senegal and Mauritania. As there are no catch limits under the agreement, the commercial value of the deal cannot be calculated,¹²⁴ though one may reasonably suspect that the commercial value far outweighs the fees paid.

The fees charged per tonne of caught tuna, however, are only 2.5 to 4 per cent of the average commercial value. According to a report by the Court of Auditors in 2001, the average value of the catches under the Senegal agreement in 1993-1997 was € 24 million, based on a catch of 24 729 tonnes (species unspecified). This can be compared with the annual cost of the previous agreement of € 12 million.¹²⁵

Furthermore, certain vessels are allowed to fish anywhere in the waters under Senegalese jurisdiction. In terms of by catches, however, limits and penalties are somewhat more rigid, as if by catches are exceeded penalties may entail the banning of certain vessels.¹²⁶ Possibilities for catching demersal fish have also been decreased by 30 per cent under the new deal and net mesh sizes have been increased in view of reducing incidental catch rates. There are also to be observers on EU vessels and 50 per cent of crewmembers must be Senegalese. However, a clause stating that any reduction of catch thresholds as a result of stock depletion will lead to a reduction of EU payments, gives Senegal little reason to respond to the deterioration in the state of fish resources associated with EU activities within their fishery. Furthermore there is little information on catch statistics under the new deal which makes it difficult to calculate bionomic equilibria and economic benefits and losses. Ironically this is in stark contrast to EU domestic fisheries

123 Charmes, J. (2004) Personal communication, Paris.

124 *Fisheries agreement with Senegal*. www.wttf.uk, p 8.

125 *Ibid*, p 9.

126 *Ibid*, p 10.

management schemes where catch levels are increasingly informed by TAC limits.¹²⁷ In general, studies indicate that the latest set of EU fishing deals off Africa's West coast are rather poorly honed, where issues of monitoring and inspection appear a little 'patchy' which make it difficult to see how even the existing regulations may be enforced.¹²⁸ Although this critique may not address FOC fishing in the region explicitly, some important conclusions may be drawn from the nature of these deals with respect to the hope of eradicating FOC fishing as well as regulating licensed fishers more effectively. There appear to be two key issues here; the first is the absence of TAC and MSY estimates in the gauging of fishing limits, the second is the perceived inability of Senegalese authorities to manage and sanction even licensed operations with mandatory controls and budget allocations for such activities. Indeed if TAC and MSY issues are of little importance to Senegalese authorities with respect to existing deals, they are likely to be similarly unimportant or superfluous when it comes to the activities of FOC vessels. In addition to this, even if the concern apropos TAC and MSY limits was viewed as being significant, if unable to regulate even well known fishers, countries are likely to be equally poorly equipped to deal with FOC fishers

As a fishery that is shared between states, the challenge of regulating fishing activity in Senegal in view of securing a healthy and sustainable migratory fish population has an added dimension. Indeed the problem of free riding may become a compelling one in the event of unilateral regulation of the harvesting of these fish populations. Supposing that Senegal effects significant regulatory measures, while its northern neighbour Mauritania does not, the resultant welfare gains from Senegal's regulatory efforts will be shared between both Senegal and Mauritania at no cost to the northern nation. For this reason effective management of fish populations which migrate between the borders of these two states requires significant collaboration, not only to exclude the possibility of free riding between states, but also to enhance the quality of information about the gross landings per population and the general state of fish stocks. Although the prescriptions under Senegal and Mauritania's co-operation agreement have already been outlined in this research, the problem of the inability of both the two states to effectively monitor their fisheries remains severe and important¹²⁹ as such policies have little significance in the absence of the

¹²⁷ Ibid, p 11.

¹²⁸ Ibid, p 18.

¹²⁹ *Mauritania and Senegal sign a fishing agreement.* (1999) Loc cit.

muscle required for enforcing their mandates.

As we have seen over fishing is frequently seen to be in the rational best interests of even otherwise benevolent individuals and groups, thus in the absence of a comprehensive plan to either restrict the activities of authorised fishers to those permitted by their contracts, or eradicate FOC vessels, there is unlikely to be substantial or meaningful reform in the industry. The eradication of these problems is not impossible. Despite being unable to find a single report of Senegalese authorities actually arresting a FOC vessel in terms of public international law, Senegal neighbouring states are well within their rights to arrest FOC vessels found within their waters and use the confiscated hardware and rent earned from its sale to regulate the industry. Such activities are justified under article 111(2) of the 1982 United Nations Convention on the Law of the Sea (UNCLOS) in terms of a state's right to enact particular regulations within its territorial sea, as well as its right to arrest ships that are found to be in breach of certain regulations.¹³⁰ It may also be feasible to use heavy sanctions against licensed fishers found to be acting in breach of their contracts to bolster regulatory infrastructures. Again reports of the implementation of such sanctions have proven elusive thus far.

According to Bacar Fall, a Senegalese fisherman and member of the Federation of Fishing Industry Interest Groups (FENAGIE), attempts to eradicate IUU fishing have been stifled for two main reasons. The first reason for this is corruption among fishing authorities, and the second is a lack of funds needed to monitor and control fishing activities in the area. According to Bacar Fall, the Senegalese government is in no position to check up on EU activities and skulduggery amongst licensing authorities and inspectors is rampant. The International Monetary Fund has supported such claims, suggesting that a major impediment to improved policy frameworks in Senegal are structural ones.¹³¹ In this case policy and enforcement frameworks are viewed as being insufficiently equipped at both conceptual and enforcement levels to deal with some of the state's policy challenges. As a result of dissatisfaction on the part of local fishers FENAGIE attempted to place its own inspectors on board EU vessels, but failed through lack of funds.¹³² Although Amadeu Wade, a project coordinator for FENAGIE, suggests that his organisation is

¹³⁰ Akehurst, M. (1992) *A modern introduction to International Law*. London, Routledge, p 184.

¹³¹ Policy framework papers. www.imf.org.

¹³² *West African marine ecoregion: the local voice*. (2000) www.panda.org, p 1.

not opposed to the fishing agreements with the EU in general, they feel that the agreements could greatly enhance the sustainable usage of the resource if there was greater collaboration between government and themselves, and a more efficient coast-guarding authority and catch inspectorate. During the last set of negotiations with the EU, FENAGIE was only notified of, and included in, the first eight of ten rounds of negotiation, and had almost no say in the nature of the agreements.¹³³ Furthermore, in the absence of external assistance Senegal's monitoring and regulatory infrastructures appear a little too modest. Yerim Tchoub, the Director General of the country's Fishery Protection and Supervision Department, acknowledges that their surveillance infrastructure is insufficient for controlling even the activities of licensed foreign vessels effectively. He suggests that frequently large quantities of unreported by catch are dumped back into the sea, which distorts the department's statistical information apropos harvest levels and fish population levels. On the matter of regulatory infrastructures in Senegal Tchoub notes:

My department is responsible for policing sea and river fisheries. Supervision is organised via maritime inspectors who carry out inspections on vessels in port and take part in missions at sea and using aeroplanes, supervising fishing operations. We are assisted by the National Navy and by a certain number of supervisory units, as well as by French forces based on the Cape Verde Islands. The support we receive from those forces is particularly valuable since the breakdown of our surveillance plane last June.¹³⁴

Indeed it may seem as if the Senegalese authorities have only a very loose grip on the reigns of their fishery resources. However despite worries about by catch and IUU fishing Senegalese authorities hold that the activities of foreign based fishing industries have a positive effect on the country's economy through stimulating industrial activities related to maritime functions and port operations.¹³⁵ Ironically the distortions associated with IUU fishing make it impossible to effectively gauge the net gains and losses associated with the fishing activity, thus the net benefits and incomes appreciated as a result of foreign fishing company activity in the region cannot be equated to the income losses associated with illegal and unreported fishing, or indeed the economic losses which may be emerging as a result of poorly honed policies. It is surely a combination of such problems as inaccurate cost benefit analyses, corruption, bureaucratic failure, obstruction of power and slow policy processes that are at the root of Senegal's apparent administrative failure with regard to its fishery. Significantly, the previously highlighted ineffective

133 Ibid.

134 Ibid.

135 Ibid.

cost benefit analyses provide little incentive to muster the political will to speed up fisheries policy processes. It is scarcely possible to hone policies aimed at streamlining distributional gains associated with fishing activity in the absence of an accurate accounting system reflecting gains and losses associated with fishery use. Effective accounting of fishery usage cannot be achieved in a fishery dominated by IUU fishing activities, which in turn cannot be eradicated without an effective structure to monitor and control fishing activity. This in turn requires political commitment and financial support. These requirements become especially challenging for a fishery like Senegal's where fish migrate between the boundaries of two or more states. Thus methodologies such as the one provided by Dupont and Phillips succumb to the unquantifiable impact of pirate fishing. The empirical estimates of fish harvesting technology mandated in the first step of the model, and calculation of the employment and income losses associated with regulation proposals, prescribed in step two,¹³⁶ are also made unattainable as a result of pirate fishing. Here again it is clear that the effectiveness of policies cannot be established when the same policies are being contravened by pirate fishing operations. It is also clear that estimates regarding the fish harvesting technologies being employed in a particular fishery will be made unreliable as a result of the secretive pirate operations. Hence the model becomes inapplicable to the two-state fishery faced by a pirate-fishing crisis. The need for a multilateral approach incorporating government and non-government organisations, and user groups is thus reinforced as a possible path toward sustainable fishery management in Senegal.

Perhaps the greatest tragedy associated with the inefficiency of Senegal's fishery policy, as well as that of other parts of West Africa, is that by failing to sanction IUU fishers effectively, the large foreign fishing enterprises achieve a comparative advantage in the production of fish products. This is a result of the large scale and cost effective methods employed by these huge foreign fishing fleets, with little consideration given for the true economic costs incurred by their hosts. If Senegal and its coastal neighbours were to sanction foreign fishing operations in keeping with the true economic costs associated with their activities, the cost of fishing would increase for these vessels. Such a step would have the effect of reducing the comparative advantage enjoyed by sometimes-exploitative foreign fleets, and placing local fishers in a stronger position in terms of world trade in fish products. Indeed this eventuality, like the streamlining of

¹³⁶ Dupont, D & Phipps, S. (2001). *Loc cit*.

fishery policies, impinges upon an improved fishery regulatory infrastructure in the region.

Chapter 5. A Market Instrument.

5.1. A New Model.

There are some key aspects to the international political economy of fishery management that must be considered in view of developing an appropriate approach to fishery regulation. The first relevant issue for this research is the one of illegal fishing on the high seas, or those parts of the ocean which do not fall under the jurisdiction of any state. Although this research does not deal with IUU fishing on the high seas explicitly, some of the results of the study may be generalizable in a way that might be useful to high seas fishing dilemmas. The second concern is the issue of government subsidies for fishing fleets. These subsidies may at first glance appear to pose a serious threat to attempts at regulating a fishery by increasing the costs of fishing, however, as we shall see later improved regulation and implementation of licensing laws can be effective against unruly fishers despite government backing. This results from the fact that proper pricing of fishing licenses provides the necessary framework for eradicating irresponsible fishing practices independently of demand side price mechanisms. The next key consideration pertains to the constraints faced by states in the political south. These states have special needs and constrictions which must be considered in order to offer the best possible plan of action for improving fishery regulation regimes in developing states. These considerations are two fold; the first aspect bears on the budgetary constraints for fishery regulation and coast guarding, while the second pertains to the need to provide improved modalities for the economic emancipation of these states.

Although much of the literature regarding IUU fishing strongly recommends the eradication of this phenomenon, through market controls, international law and the moral persuasion implicit in contemporary plans of action, these mechanisms may be ineffective or even unnecessary given a nuanced approach to fishery management. Indeed the moral persuasivity of international plans of action appears to be a soft argument in the face of the enormous impetus for free-riding behaviour. Secondly, international law offers only the very beginnings of a underdeveloped international system of governance in an international environment of sovereign states, and it may be some time before the system is sufficiently capable of dealing with the IUU fishing problem. Lastly, it would appear that in attempting to address fishery dilemmas using market mechanisms while simultaneously adhering to all of the principles of liberal trade and WTO rules is to un-

determine the integrity of regulatory plans. Although environmental prudence may be a growing characteristic of international trade, this does not make an argument for addressing environmental concerns by using trade mechanisms which are based upon liberalizing controls rather than implementing them. Hence despite the developments that have been made in the field of IUU fishing, certain characteristics of international plans as well as constraints faced by policy makers may create arguments for new policy approaches to fishery management.

It would appear that given the above-mentioned problems with current international status quos, regional bodies combining government and non-government appendages might provide workable solutions to IUU fishing dilemmas. Yet any such organization, government, non-government or mixed must follow certain protocols. First and foremost must come a means to evaluating the economic values of fish stocks in order to provide impetus for further regulation, and indeed in order to provide a yardstick for sanction schemes.

Key to ensuring the conservation of fishery resources is an effective method for quantifying the determinants of reservation prices, through establishing market prices that include the costs associated with the depletion of the resource. However, in the event of government subsidies on fishing activities, such demand and supply based logics may be obscured. Thus reservation prices may be utilised in a different way, where these price levels are manipulated through increasing the cost of fishing by charging taxes or licensing fees, which aim to provide the necessary revenue for regulating the fishery. At this price level, where the costs of regulation are factored into the cost of fishing, reservation prices of fishing will rise, and the impetus to fish more today will decrease.

It is therefore conceivable that a solution to the problems connected to pirate fishing can be overcome. This section suggests a two tiered policy approach to fishery management which may have the effect of bringing about the sustainable use of fish resources and an end to pirate fishing. This approach involves a model which seeks to build accurate indicators which are accessible to the relevant authorities, regarding the amount and price of fish being exchanged in the market place. This information is likely to facilitate the quantification of policy-related information such as the reservation price of fishing. In addition, for the first time governments in pos-

session of valuable fisheries may be capable of correctly estimating the economic losses associated with the depletion of those resources.

The model impinges upon the liberalising of trade in fish products in the global market. Importantly, the two tiers of this approach must be inextricably connected in order for the model to yield accurate factor and product market indicators.

The tiers aim to achieve the following:

Tier 1.

1. Knowledge about the quantities of fish removed from a given fishery, including fisheries which span the territories of more than one state.
2. Transparency regarding the rents earned from the sale of harvested fish products.
3. Transparency regarding the costs incurred in harvesting fish.

Tier 2.

1. Information about the state of fish populations.
2. The installation of an independent coast guard authority for policing entire fisheries against pirate enterprises.

Importantly, knowledge about the fish removed from each region must be counted collectively, or as per the fishery from which they were taken. This must be done in order to observe the effects of fishing on the entire fishery and not only that portion of the fishery which is found within the waters of a particular state.

The objectives here are therefore to observe the amounts of fish removed from a fishery in a given period, and aggregate the net economic benefits associated with this activity. The purpose of these measures is to provide a framework for accounting for the economic value of these resources in each period, hence informing states as to the potential present and future gained and lost earnings associated with the management of this precious resource. Information about the costs incurred in fishing are necessary in order to inform the prices of fishing licences ensuring that the costs of compliance are not greater than the costs of non-compliance. Information

about the state of health of the fishery's fish population is necessary for ensuring that the level of fishing that is permitted accords with a biologically sustainable yield. An independent coast guard authority is required to keep pirate-fishing vessels out of the fishery, and to protect the interests of neighbouring states from overzealous exploitation of a shared fishery by another state.

The first tier of this approach therefore involves the registration of all fishing industries (which operate above a designated output threshold) for a given fishery with a central trading authority, and the second requires the imposition of a tax based upon fish product sales which can be used to regulate the exploitation of fisheries, and eradicate pirate fishing. This regulation may be done in a number of ways. Ultimately though, regulation will require the employment of independent officials with designated tasks pertaining to mapping and policing the harvesting of fish resources. The rationale behind this approach is to ensure that all fish products are bought and sold in an open market in order to use market forces to gauge the demand and supply of fish.¹³⁷ Simultaneously, demand and supply is carefully regulated by adjusting the costs of fishing through the pricing of licences and/or quota limits. Using the internet as a facilitator for this trading network will assist in making the market globally accessible, as well as making information regarding the numbers and prices of fish sold, easily obtained and mapped. This will enable the authorities responsible for regulating fishery use to estimate the monetary value of the fishing permits sold, thus informing more accurately the value of such licences. Furthermore, information about the number of fish removed from various populations can inform quota restrictions in order for fisheries to be managed in accordance with their biological population equilibrium levels.

Similar internet-based trade networks for fish products have proven successful in the past. In June 2001 the Australian *Sydney Fish Market* (SFM) began developing an electronic marketplace in the hope of capturing a larger share of the world's market for fish products. The result of this endeavour has been a terrific commercial success, enhancing the efficiency of the SFM,¹³⁸ and providing evidence that similar systems may provide workable solutions for other fisheries.

¹³⁷ Parkin, M. (1993) *Loc cit*.

The second tier of this model involves sanctioning fishing activities by means of mandatory taxes, tariffs, or ITQ's for fishing activities within a particular fishery, the revenue from which may be used to fund the policing of fisheries against piracy. Such natural resource taxes have been implemented in the past where a resource is required to generate some additional revenue for the authorities which oversee their usage.¹³⁹ In this case effective coast guarding results in the eradication of illegitimate fishing enterprises, and greater certainty among the buyers and sellers of fishing quotas and licences that they get their just deserts free from the capital leakages characteristic of fisheries in which pirate fishing is rampant.

Fishing will ultimately be operating in accordance with the true cost, through incorporating into fishing costs, the prices of quotas and licences. The prices of the latter will be informed by the reservation price of fishing for that particular fishery. The implementation of this model makes the forecasting of the problematic determinants of reservation prices more possible through the provision of important information regarding some of the more enigmatic variables; namely the expected future price of the resource, the expected future cost of fishing, and the optimal level of harvest. Necessarily the full implementation of the model will make estimations about the potential for the rehabilitation of the resource sharper. Although this model does not explicitly provide values for each determinant of reservation prices, the extensive monitoring of the use of the fishery associated with its implementation provides much of the foundation material for approximating such values. Furthermore, by providing accurate information apropos the quantity of fish removed per session, the model offers a fine foundation for the estimation of values such as the OSY and MSY for a given fishery

In view of the Heckscher Olin theory of international trade, the ramifications of the implementation of this model become somewhat exciting in the developing context. Indeed one of the chief concerns for fishery bodies in many parts of the political South is how to redistribute rent gains from fishing in a way that is more favourable to smaller local industries and user groups. Furthermore the export of fish resources may be viewed as a potentially lucrative means to improving balance of payment problems. Supposing that the regulatory model proposed above man-

138 Sydney Fish Market casts its online net, (2003) www.ditm.nsw.gov.au, pp 1-3.

139 Joffe, H. (2003). State open to talks on royalty tax measures. Johannesburg Business Day 02/05/2003, p 1.

ages to align the costs of fishing with the true cost of ensuring the long term sustainability of the resource. In other words, supposing the model succeeds in incorporating the costs of effective regulation into the costs of fishing, then local fishers may find themselves in a more favourable position apropos comparative advantages. Indeed the efficiency of large scale fishing operations may be something to be reckoned with, but given advantages enjoyed by local fishers such as geographical proximity to the resource, the absence of a need to freeze fish for long periods, and perhaps slightly more lenient licensing fees, small local fishing companies are likely to find themselves in a favourable position in terms of producing fish products with a comparative advantage. Hence, as Hecksher and Ohlin might suggest, by increasing the costs of fishing for foreign trawlers, local fishers are well placed to engage in international trade in fish products from a stronger position by virtue of an implicit comparative advantage. It is this advantage which has been perverted by ineffective regulatory controls and poorly tuned licensing measures. Thus rearranging taxing and licensing protocols for certain fisheries may not only yield the long term sustainability of the resource, but also provide a vehicle for uplifting local industries and improving export levels and balance of payments problems. It is important to note that the objective of raising the cost of fishing is not explicitly to elicit a demand side decrease in the quantity of fish demanded by invoking a price increase, but rather to provide a means to retrieving funds required for the effective management of a fishery. Hence in the case of a fishing industry which is heavily subsidised by a government or governments, the price of fish may remain relatively low to the household consumer, while the costs of extracting the resource have aligned with the costs of ensuring the long term sustainability of the resource, thus increasing the reservation price of fishing and creating an incentive to save fishing effort today for fishing effort tomorrow (and the next day).

5.2. Senegal and the Model.

In order to apply this model to the case of the Senegalese fishery we must first take into account some of the characteristics faced by this fishery. Indeed it may seem that the obvious problems for the Senegalese fishery are the prevalence of IUU fishing, and an apparent shortage of regulatory muscle. However, there are other important characteristics that should not be discounted, such as the shared nature of this fishery, comprising fish populations which migrate between the EEZ's of both Senegal and its northern neighbour Mauritania. Likewise we must

consider the pressures faced by small user groups on the country's coast line, and the associated economic pressures that the increasing pressure on this resource is placing on the country's already fragile economy. Additionally, one may consider that the IUU fishing problem in Senegal is not restricted to FAC fishing per se, but to a broader based problem of over-fishing and mis-exploitation of the fishery by legal foreign-based enterprises as well as local ones.

In terms of a *Hardin's tragedy of the commons dilemma* the state of Senegal's fishery may be illustrated by figure 4.1 (below), which has been adapted from the previous chapter. In this game, the fishery is faced by a status quo in which both legal users A and B are committing tragedy of the commons indiscretions, while user P fishes in a completely illegal, unreported and unregulated manor. Using information from Senegalese surveillance efforts (which suggest that on certain days as many as half of the ships in the country's waters are flying flags of convenience) to inform the variables used in this figure, one may reasonably suggest that fishers denoted by P extract a quantity equitable to $Q = 10$ (a little less than half of the quantity removed by so called legitimate fishers.)

Game theoretic fishery modality.

Figure 4.1.

F	A.	B.	P.
Q	12	12	10
SC	-7	-7	
AC	= 14		

Suppose now that the Senegalese fishery authorities simultaneously implement the first two tiers of the model, in accordance with the Mauritanian authorities. Acting in tangent the results of this cooperative policy compliance in two-country environment produces some interesting results. Whereas formerly the two-country model provided some problems associated with competing interests apropos policy implementation, the cooperative approach yields an unusual and new outcome. Figure 5.1 below illustrates a point in the world market for fish products at which the supply of fish products shows a broad based affect of multilateral policy compliance. Where formerly markets for fish products based on Senegalese and Mauritanian fish products may have

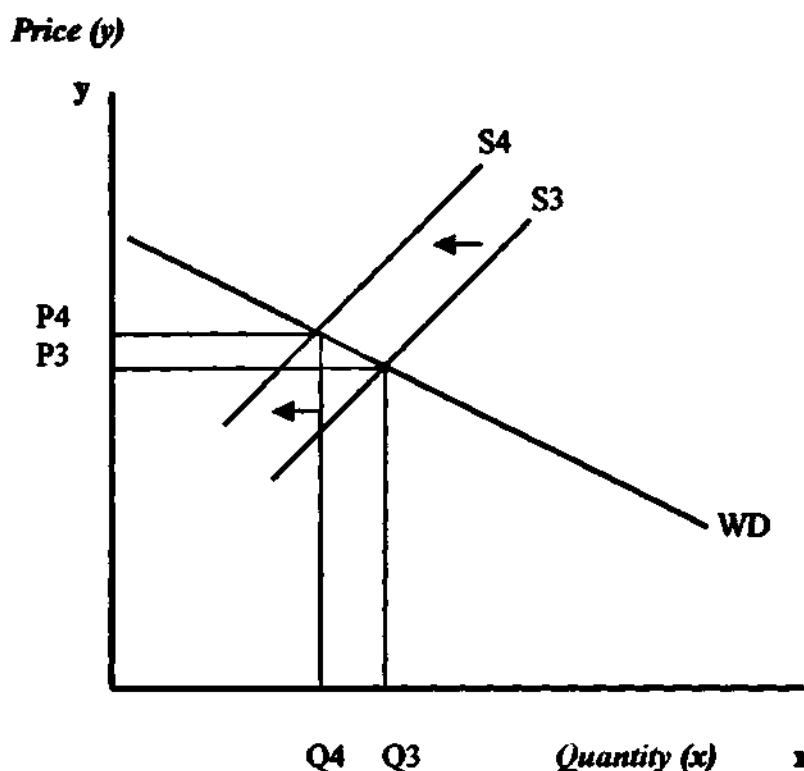
settled at an equilibrium position where licence prices accounted for approximately 2.5 to 4 per cent of the fish's commercial value (at P3, Q3) the advent of co-operation between the two states, creates a new equilibrium of P4, Q4 where licences account for a greater portion of the commercial value of fish products thus slowly pushing prices upward. At this point both countries in the two-country environment have implemented similar policy controls over fishing activities. The result of this behaviour has been to lower the harvest rate and supply of fish products, which leads to a corresponding increase in the price for fish products. Ironically the catastrophic state of global fish populations facilitates this cooperation by way of the resultant supply deficit which places the producers of fish products in a stronger position to bargain for more rigid policy measures. Now by forming an alliance in this situation of a supply deficit, Senegal and Mauritania might use their proximity to their advantage.

In this case, FOC and other forms of IUU fishing will be virtually eradicated by stricter controls, while the new fish sales monitoring system provides the basis for monitoring the activities of fishers inside the shared fishery, but outside of Senegal's EEZ. In this way Senegal may not only be able to forecast more effectively the biologically sustainable fishing levels for their fishery, but also will be able to better estimate the economic value of this resource as well as some of the possible costs of misregulation. By adjusting tax incentives and disincentives, and the quantity and price of licences or quota restrictions, fishery authorities may be able to bring the costs of fishing into line with the costs of ensuring the sustainability of the resource. In this way costs of fishing will rise, while, and importantly, IUU fishing will be restricted to reasonable levels by rigid and effective coast guarding and monitoring of fishing activities. The results of this will be to reduce AC to nearly zero, and to eradicate the presence of fisher P. Now A and B may be able to harvest fish in a sustainable and fair way. In this way MSY and equilibrium catch functions, as represented by a product of Yield Effort (YE) in figure 6.1, may shift into sync.

With respect to the most recent deals between Senegal and Mauritania and the EU the most important factors to consider are that licence prices and catch restrictions are in no way informed by MSY estimates. Hence catch limits are not determined by TAC estimations as they should be, but rather by the willingness of fishing companies to pay for excess tonnage of fish caught. Given that estimations suggest that the cost charged per tonne of certain species under

current agreements lies somewhere between 2.5 and 4 per cent of the commercial value per tonne, it would seem that using willingness to pay for extra tonnages as a means to restricting catch levels is hardly reliable. The need to manage deals in accordance with MSY and TAC levels is therefore enormous as such limits act as a means to limiting fishing effort.

Figure 5.1 The effect of policy compliance in a two-country environment.

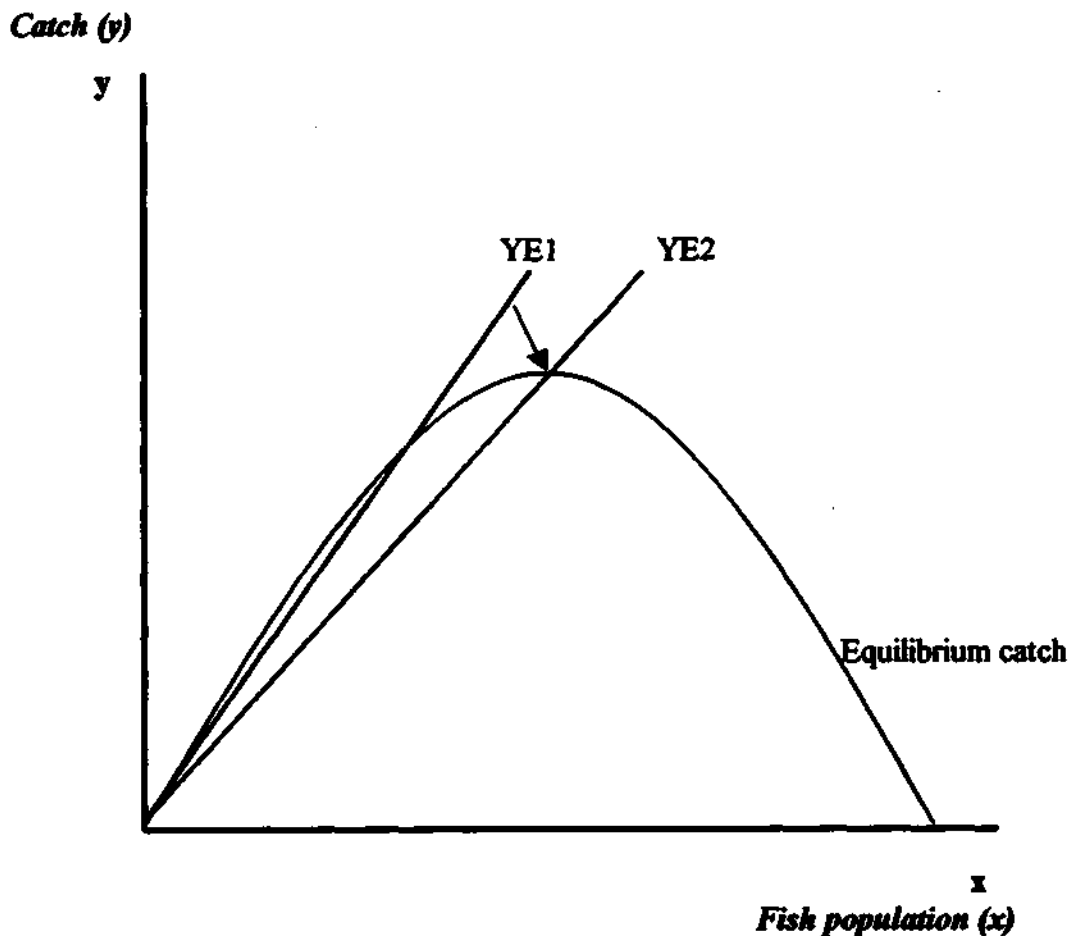


(From Frieden, J & Lake, D. p 440)

The figure below shows how adjusting fishing effort in a fishery by way of licensing and or tax restriction can cause fishing levels to come into line with sustainable yield levels. The fishery depicted here reflects the Senegalese as being exploited at a point above the equilibrium catch function on YE1 in the absence of regulation, the implementation of effective policy controls causes a downward shift in fishing effort to the interception of YE2 and the equilibrium catch function. At this point fishing may be sustained indefinitely.

Figure 6.1

**Equilibrium Catch and Yield-Effort
functions for a fishery.**



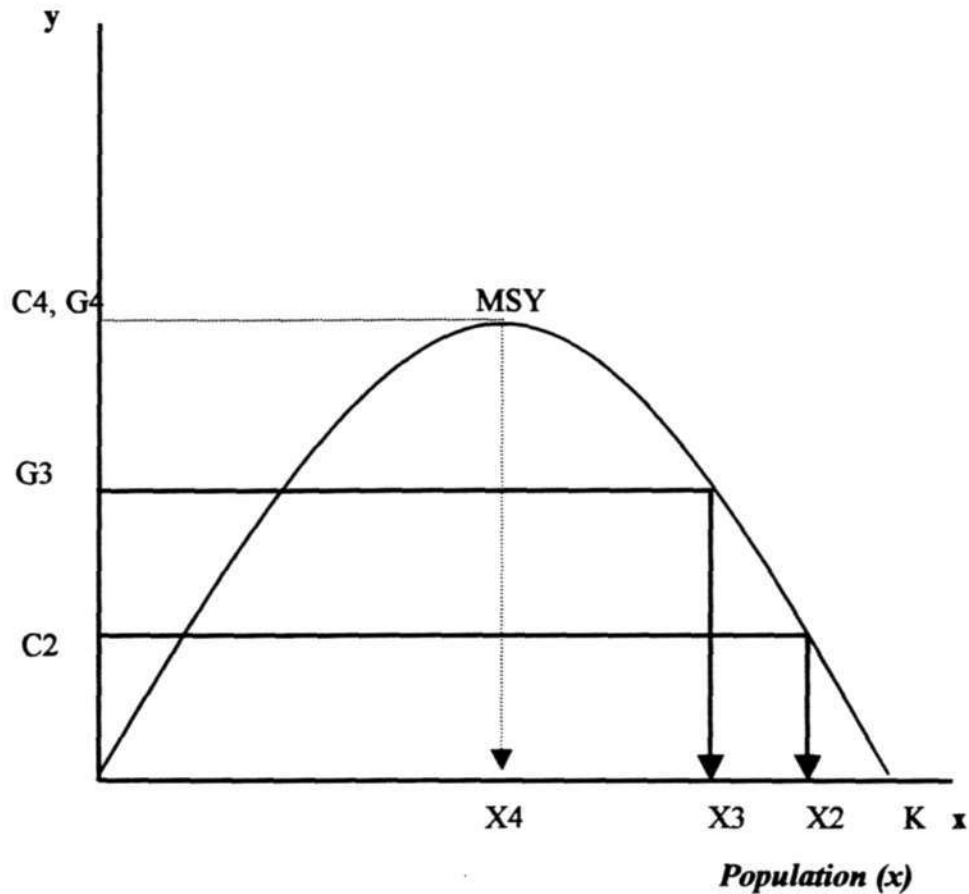
(From Khan, J. (1995))

Now fish populations may slowly correct themselves as harvest rates decrease and fish population growth rates increase. Figure 7.1 illustrates this shift, where catch rates have been reduced to C_2 at a population level of X_2 , with the resultant increase in growth represented by G_3 at a growing population level of X_3 . Ultimately, sustained growth in the fish population, resulting from lowered catch rates, may allow the population to reach a suitable level, where the MSY may be economically lucrative. This end-goal point is shown by C_4 , G_4 at a population size of X_4 , where catch and population growth rates are equal at the greatest possible level of exploitation for the fishery.

Figure 7.1

Harvest and fish population growth rates.

Catch, Growth (y)



(From Khan, J. (1995))

Unfortunately the unavailability of information about the Senegalese fish populations makes it impossible to provide meaningful MSY and YE estimations. This comes as the result of the lack of fishing quotas and accurate accounts of catch levels in the region, thus rendering the two graphs used above instructive in a theoretical sense only.

Ultimately the implementation of this model brings the Senegalese fishery to the status quo represented by figure 8.1, shown again below, where fishers A and B fish at equilibrium levels in the absence of illegal fisher P. Importantly, in this new case AC is equal to 0 and the rent seeking impulses of fishers are tempered by an effective regulatory authority.

**Game theoretic outcomes of effective fishery
management.**

Figure 8.1.

F	A.	B.
Q	10	10
SC	-0	-0
AC	= 0	

Again the unavailability of reliable information with regard to the state of the Senegalese fishery and catch rates within it makes accurate estimations bearing on the figures above somewhat difficult. However in a hypothetical sense, having achieved the basic goal of protecting the fishery from the threat posed by IUU fishing, plans such as those suggested by Dupont and Phipps may be implemented in view of fine tuning some of the smaller details pertaining to the political economy of the fishery, such as welfare gains between user groups, and other such redistribution benefits bearing on adjusting tax and wage rates, and other such variables. In this way the usage of this fishery may take some important steps toward not only being bionomically sustainable but more economically efficient. Furthermore such plans make the benefits of rearranging tax and licensing structures more in tune with those hinted at by Hecksher and Ohlin in view of maximising comparative advantages in the production of internationally traded goods.

Chapter 6. Conclusion and Recommendations.

Concepts such as sustainable development and ecological modernisation, which aim to marry economic development to ecologically sustainable practices, can be credited with at least highlighting those ecological issues having some bearing upon developmental ones. This advent comes in spite of the often vague or unclear nature of the definitions used by those purporting to adhere to these concepts in the public and private policy environment. However, Anthony Giddens argues that there have been two key oversights with regard to these concepts:

The somewhat comfortable assumptions of ecological modernisation deflect attention from two fundamental questions raised by ecological considerations: our relationship to scientific advance, and our response to risk.¹⁴⁰

The relationship between scientific advance, risk and the political processes which govern the nature of their relativity has illustrated some issues which are central to the research questions for this thesis. The case of the Senegalese IUU fishing dilemma shows that, in this case, the actors who are employing their technological muscle close to its fullest potential are fishers with little concern for the risks associated with the long-term depletion of Senegal's oceanic fish population. The lack of concern for scientific information and technological advances which might enhance the regulation of the fisher, on the part of the relevant policy makers in the region clearly shows a similar disregard for the risks associated with the depletion of these important fish stocks. As the author has argued this alarming situation is surely due to an array of factors, the most important of which are the ineffective and dishonest cost-benefit analyses used to gauge the welfare gains and losses associated with the harvesting of the country's fish stocks.

In the absence of significant scientific information on fishery population health, and mechanisms for the regulation of Senegal's off shore fishery, this research has had three core aims. These aims have been to explore the reasons for the lackadaisical approach to the risks associated with the depletion of Senegal's fish resources on the part of the country's important policy figures, and to help to provide both the political impetus and economic mechanisms required to invoke and see through a more risk averse attitude toward fishing activities in Senegal.

To this extent this research has aimed to accord the price of fish in the marketplace with the price level which is true to the cost of fishing, including the long-term costs associated with the

future availability of the resource. Combining the invisible hand of the free market and rigid regulatory policy controls provides the necessary incentives and disincentives for supplying and purchasing fish products, therefore providing the monetary means to eliminating practices that are economically inefficient and conducive to the over-exploitation of the fishery. Furthermore, greater technological support for mandating and monitoring catch thresholds will provide policy makers with a more accurate sense of the losses associated with over, or uncontrolled fishing.

Accurate and insightful policy implementation, as advocated by Diane Dupont and Shelly Phillips may be afforded the opportunity to have a gradual but beneficial effect for artisan fishing communities. These communities hopefully, will not only enjoy the fruits of the rehabilitation of fishery populations as a result of a more efficient fishery regulation program and the eradication of pirate fishing but also enjoy the benefits of policy approaches that for the first time can accurately take into account their orientation within the distributional outcomes of policy adoption.¹⁴¹

The incidental effect of the implementation of this model is to make the information required for policy appraisal accessible to those developing states that are subject to the distorting effects of pirate fishing. Such a policy approach to the management of fisheries suffering from pirate fishing may indeed provide the blueprint for a status quo in international fishing regime which is sufficiently sensitive to some of Kahn's transcendental concerns. Considerations such as those pertaining to incidental catch, the pollution of marine fisheries, and conflicts between user groups may be extinguished through effective monitoring and policing of fishing practices combined with policy approaches which secure bionomic sustainability for fishery resources.

The solutions to IUU fishing in the developing context proposed within this thesis are, however, not without a sense of irony. As was argued earlier, it is not easy for developing states to tighten fishing restrictions, particularly when such actions may jeopardise renewal of fishing deals. States may therefore be compelled to avoid making fishing regulations within their EEZ's stricter than those of their neighbours. However, such states may be presented with the perfect window of opportunity to implement more rigid policy controls as a result of the barren state of

140 Giddens, A. (1998) *The third way: the renewal of social democracy*. New York, Polity Press, p 58.

global fisheries. Hence the supply deficit for fish stocks places states in possession of those stocks in a stronger bargaining position when it comes to regulating the exploitation of that resource. The scarcity of fish decreases competition on the supply side but increases on the demand side. This gives suppliers (states in ownership of fish resources) an opportunity to increase the stringency of their regulatory measures with relatively little risk of being out-competed by other suppliers. Indeed one possible situation would see suppliers come together to agree on sustainable and appropriate regulatory measures, which may inevitably incorporate an increase in the costs of fishing for those demanding access to fish resources. Perhaps problematically this situation could lead to a fisheries cartel or monopoly held by states that run their fisheries in a sustainable way. The ramifications of this scenario can only be guessed at at this stage though.

The second irony which is implicit in the recommendations of this research is perhaps more compelling than the first. Although suggesting that the costs of fishing need to be raised to a level that can incorporate the sustainable usage of the resource may seem like a necessary measure given the state of global fish stocks in the absence of such a plan, this plan may indeed have a negative effect upon the starving populations of the world. Even if third states in possession of fishery resources manage to rearrange international trade and fishing sanction schemes in favour of providing themselves with a comparative advantage in the production of and trade and trade in fish products, the likely increase in the price of fish associated with more efficient regulation of the resource may make fish proteins inaccessible to the poor and hungry peoples of the world. Such a development would have the effect of reinforcing dependencies on international monetary and food aid. In response to this problem one may only suggest that fishery regulation policies are fine tuned in such a way as to provide sufficient welfare gains to the poorer inhabitants of fishery states. A possible solution to this dilemma may be to sanction large-scale industrial fishers more heavily than small artisanal fleets, thus allowing artisanal fishers to fish at a comparatively low cost, enabling them to sell fish products at an affordable market price. It would be a tremendous tragedy if the findings of this research made fish products inaccessible to the poor peoples of Senegal who may find themselves unable to afford the higher prices demanded for fish as a result of greater regulatory stringency and the imposition of license and quota measures. For this reason it may be useful to examine the possibilities for a system which

141 Dupont, D. & Phipps, A. (2001) *Op cit*, p 214.

favours large scale and highly efficient industrial trawlers more heavily than small artisanal fishers. Such a system may make it possible to regulate a fishery at a macro level while allowing micro fishing industries to subsist and continue to provide fish products to local people at more favourable price levels. This is not to say that artisanal fleets should be allowed to fish without restriction, but rather to suggest that such small scale fishing companies should be subject to certain concessions apropos licensing costs. Indeed policy makers may wish to address a number of concerns with regard to artisanal fleets. Such considerations may range from protected areas, fishing techniques, protected species to biological rest periods and catch levels, however, a key difference between the policy treatment of small scale fishers as opposed to their industrial counterparts must encompass sanction levels that accord with the income and efficiency, or returns to fishing effort enjoyed by respective fishing enterprises. Indeed it is most likely that large industrial fishers enjoy far higher returns for their fishing effort than smaller artisanal fleets, hence it may be in the best socioeconomic interests of the state's policy providers to recognise these differences and adjust policy treatments accordingly. A plan like this may for example encompass the scaling of license prices and quota restrictions according to gross tonnage for particular species, regions or fishing techniques. Measures like this would however depend tremendously upon the specificity of the constraints which characterise fishing activities within different quantity, species, methodological and regional sectors, each with a specific variety of recommended policy protocols. The result of such a plan may be to provide the basis for eradicating IUU fishing and streamlining the economic efficiency of fishing activity in a given fishery, while providing for the nutritional and socio-economic interests of the less formal fishing sectors and their dependants.

In an exploratory way this thesis has been restricted by the severe shortage of information on the state of Senegal's fish population and fishing industry. This no doubt results from the country's stake holders' lax attitudes toward the associated risks of fishery resource depletion. As it appears, such figures are unavailable as neither statistical accountability nor catch thresholds are mandated by current Senegalese fishing agreements. Although the study has provided a model for improving the ecological and economic sustainability of fishing operations in Senegal, its main contribution must emerge from its resultant recommendations. In retrospect of this research process, one may be able to say with some authority that the well being of fish resources

in the area will only come as a result of greater efforts to understand the health of the fish population and to adjust fisheries policies accordingly. This insight creates recommendations for both action and further research. On the one hand action is required on the part of Senegalese fishery policy makers to set catch restrictions and mandate stringent recording of catches. On the other hand, if this resource is to be exploited at maximum efficiency, further research is required to examine and suggest the status quos that are necessary in order to achieve this efficiency. Importantly, if catch levels and fish population health are to be understood in view of improving efficiency apropos the exploitation of Senegal's ocean fishery, IUU fishing must be eradicated as a first measure.

Bibliography.

Books:

- Akehurst, M. (1992) *A modern introduction to International Law*. London, Routledge.
- Arnold, F. S. (1995) *The economic analysis of environmental policy and regulation*. New York, John Wiley & Sons.
- Babbie, E. & Mouton, J. (1998) *The practice of social research*. Cape Town, Oxford University Press.
- Barry, B. (1979) *The subordination of power and the mercantile economy*. in Cruise O'Brien, R. (1979) *The political economy of underdevelopment*. London, Sage.
- Beatley, T. Brower, D. J. & Schwab, A.K. (1994) *An introduction to coastal zone management*. Los Angeles, Island Press.
- Boulding, K. E. (1992) *Towards a new economics*. Aldershot, Edward Elgar.
- Broad, R. Cavanagh, J. & Bello, W. (2000) *Development: the market is not enough*. In Frieden, J. and Lake, D. (2000) *International Political Economy* 4th Ed. New York, Routledge.
- Butler, A. (2000) *Environmental protection and free trade: are they mutually exclusive*. In Frieden, J. and Lake, D. (2000) *International Political Economy* 4th Ed. New York, Routledge.
- Clark, C. W. (1990) *Mathematical bioeconomics: The optimal management of renewable resources*. 2nd Ed. New York, John Wiley and Sons.
- Cone, J. (1995) *A Common Fate: endangered salmon and people of the Pacific Northwest*. New York, Henry Holt & Co.
- Connely, J & Smith, G.(1999) *Politics and the environment*. London, Routledge.
- Dupont, D. & Phipps, S.(2001) *Distributional consequences of fisheries regulations*. [no place] Canadian Economics Association.
- Earwell, J. Milgate, M. & Newman, P. (1987) *The New Palgrave: A dictionary of economics*. London, Macmillan Press.
- Fish, S. (1989) *Doing what comes naturally : change, rhetoric, and the practice of theory in literary and legal studies*. Durham, NC, Duke University Press.
- Foster, J. (1997) *Valuing nature? economics, ethics and environment*. London, Routledge.
- Frieden, J.(2000) *International investment and colonial control*. in Frieden and Lake. *International political economy*. (2000) London, Routledge.
- Garrod, G. & Willis, K. G. (1999) *Economic valuation of the environment*. Cheltenham,

Edward Elgar.

Giddens, A. (1998) *The third way: the renewal of social democracy*. New York, Polity Press.

Gobson, C.G. (1999) *Politicians and poachers*. New York, Cambridge University Press.

Goss, B. A. (1986) *Futures Markets: Their establishment and performance*. Kent, Croom Helm.

Hurrell, A. & Kingsbury, B. (1992) *The International politics of the environment*. Oxford, Clarendon Press.

Kahn, J. (1995) *The economic approach to environmental and natural resources*. Orlando, Harcourt Brace.

Kahn, J. (1998) *The economic approach to environmental and natural resources*. Orlando, Dryden Press.

Lindert, P and Pugel, T. (1996) *International economics*. New York, Times Mirror.

Low, N. (1991) *Planning politics and the state*. London, Unwin Hyman.

McEvoy, A. F. (1990) *The fisherman's problem*. New York, Cambridge University Press.

Mouton, J. (2001) *How to succeed in your masters and doctoral studies*. Pretoria, Van Schaik. p 179.

Olson, M. (1971) *The logic of collective action: public goods and the theory of groups*. Cambridge Mass., Harvard University Press.

Ostrom, E. (1990) *Governing the commons*. Cambridge, Cambridge University Press.

Parkin, M. (1993) *Economics, 2nd Ed*. Amsterdam, Addison-Wesley

Pearce, D. & Turner, R.K. (1990) *Economics of natural resources and environment*. London, Harvester Wheatsheaf.

Rimmer, D. (1984) *The economies of West Africa*. London, Weidenfeld and Nicolson.

Riekert, N.H. (2000) *Underpinning underdevelopment*. New York, The Times, April 27.

Schaefer, M.D. (1957) Some considerations of population dynamics and economics in relation to the management of marine fisheries. *Journal of the Fisheries Research Board of Canada*. Vol. 14: 669-681.

Seitz, J. L. (2002) *Global issues; an introduction. 2nd Ed*. Oxford, Blackwell.

Simmons, I.G. (1991) *Earth air and water, resources and environment in the Late 20th Century*. London, Routledge.

Stapley, N. F. (1984) *The Stock Market: A guide for private investors*. Cambridge, Woodhead-Faulkner.

Thomson, A. (2000) *An introduction to African politics*. London, Routledge.

Tisdell, C. A. (1991) *Economics of environmental conservation*. Amsterdam, Elsevier Science Publishers.

Titanberg, T. (1992) *Environmental and natural resource economics, 3rd Ed*. New York, Harper Willins.

Ulph, A. M. (1999) *Trade and the environment*. Northampton, Edward Elgar.

van den Bergh, J. (1999) *Handbook of environmental and resource economics*. Northampton, Edward Elgar.

van Vliet, M. (1993) *Environmental regulation of the business*. In Kooiman, J. (1993) *Modern governance*. London, Sage.

Articles :

Joffe, H. (02/05/2003) *State open to talks on royalty tax measures*. Johannesburg, Business Day

Samudra, (2003) *Joining in a bit late*. Samudra, November 2003.

Personal Communications:

Charmes, J. (2004) Personal communication. March, Paris.

Jones, A. (2003) Personal communication. February, Pietermaritzburg

Uzodike, N.O. (2003) Personal communication. July, Pietermaritzburg.

Uzodike, N.O. (2004) Personal communication. May, Pietermaritzburg.

Internet Sources:

Afrol News. (2001) *Europe discussing Mauritanian fisheries quotas*. www.afrol.com.

Afrol News. (2002) *Senegal and EU finally agree on fishing deal*. www.afrol.com.

Ambabi, S.K. (2000). *Presentation on the Namibian fisheries compliance on monitoring, control and surveillance*. www.europa.eu.

Bray, K. (2000) *Illegal, Unreported and Unregulated (IUU) Fishing*. www.europa.eu.

Brown, P. (2002) *Summit agrees deal to save fish*. www.guardian.co.uk.

Bright and Associates. (2002) *International trade in fish products*. www.ditn.nsw.gov.au.

Common Dreams Organisation. (2001) *Notes on international fishing dilemma*.
www.commondreams.org

Cripps, S.J. Oliver, A. & Cator, J. (2000). *International aspects of the control and eradication of IUU fishing – an NGO's perspective*. www.europa.eu

Dakarcom (1999) *Mauritania and Senegal sign a fishing agreement*. www.dakarcom.com.

Doulman, D. (2000) *Events leading to the elaboration of an international plan of action to combat illegal, unreported and unregulated fishing*. www.europa.eu

Greenpeace. (2001) *Pirate fishing plundering the waters of West Africa*. www.greenpeace.org.

Guardian U.K. (2000) *Fishing for future*. www.guardian.co.uk

One World Organisation. (1999) *Notes on West African fishery*. www.oneworld.org

Papa Samba Diouf et al. (1999) *Combining traditional and modern practices in fisheries / Sine-Saloum-Senegal*. www.csiwisepactices.org.

Policy framework papers. [no date] www.imf.org.

SAUP (2003) *Notes on Senegalese fishery policy*. www.saup.fisheries.ubc.

Senegal's poverty reduction strategy. (2002) www.poverty.worldbank.org.

Somali Watch Organisation. (2001) *Notes on international fishing regime*.
www.somaliwatch.org

West African marine eco-region: the local voice. (2000) www.panda.org.

World Wildlife Fund. [no date] *Fisheries agreement with Senegal*. www.wwf.uk.