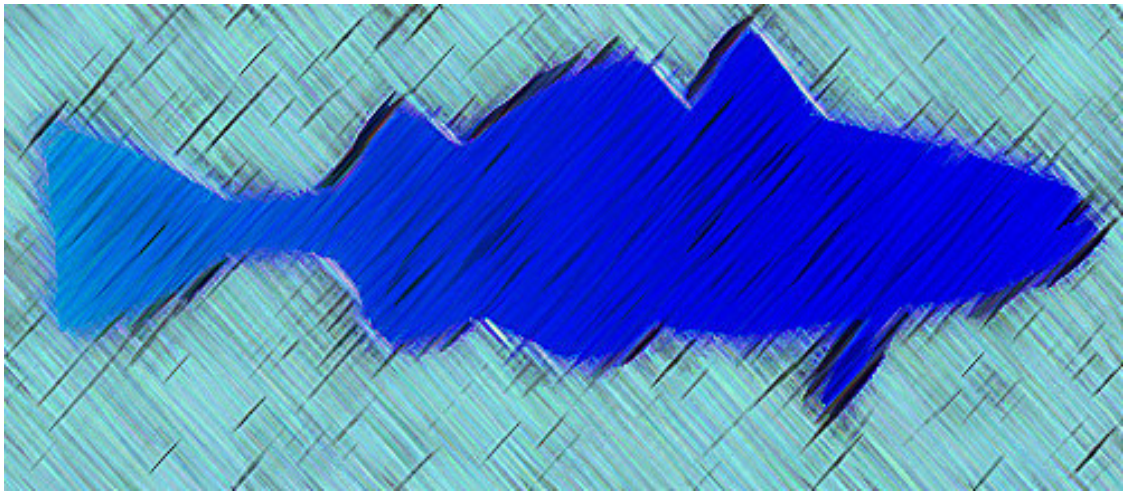
MICRO-ECONOMIC SYSTEMS ANALYSIS OF THE BCLME COMMERCIAL MARINE FISHERIES

BCLME Project LMR/SE/03/03



PRESENTED TO:

BCLME Benguela Current Large Marine Ecosystem Programme

BCLME Activity Centre for Living Marine Resources

PRESENTED BY:

ENVIRO-FISH AFRICA

ON BEHALF OF:

ENVIRO-FISH AFRICA FEIKE UNIVERSITY OF CAPE TOWN tralac BRUCE SHALLARD AND ASSOCIATES Strategic Fisheries Management Advisors

THE CONSORTIUM

JUNE 2006

EXECUTIVE SUMMARY

A fishery run as a perfect monopoly seeking to maximize its profits over time, and secure in its monopoly rights, will try to maximize the present value of its economic rents or profits over time. To do this it will have to exploit the resource sustainably, keeping up the level of the resource so as to keep up its catch per unit effort, and keep down its costs. Its interests would be quite congruent with those of most state fisheries managers. The moment that the industry shifts away from pure monopoly and becomes competitive, the interests of the resource managers and of the firms become divorced. The gap between them grows greater the weaker the property rights regime, the shorter the lifetime of permits and the more open the access to the industry. Most attempts by the resource managers to rectify this problem and maintain the stock of fish at reasonable levels are not only bound to fail, but to do so at a cost, reducing the rents in the industry even further. The reason is that any state control operates as a contract between two parties: the state and the fisherman. The state may be acting in the fishing industry's best interests, but the individual fisherman sees himself *competing* with others, and strives to maximize his personal welfare at the expense of the others in the industry. If every fisher is doing so, then the industry itself ends up behaving irrationally. Put simply, what appears rational to a profit maximizing fisherman as an individual is irrational for fishermen as a group if it is repeated by every other fisherman. The state has to pressure fishermen into acting in their own best long-term *group* interests rather than their own narrow and short-term *personal* interests. Effectively the managers of the fish resource in any country have to coerce a competitive industry into harvesting at the same rates and in the same manner that it would were it a fully informed pure monopoly, and to do so at the least possible cost.

In the Benguela ecosystem the problem is compounded by a number of factors:

- Some of the major fish species are straddling stocks; this means that the fish could not only be competed for by fishermen within a country, but by the fishing industries and state managers of the neighbouring countries across whose borders the fish move.
- The control systems, quotas, permit conditions etc across borders may not be aligned.
- The modelling of stocks on which controls such as TACs are based uses catch and survey data. Without collaboration each state may be making decisions about rates of harvest without having the full set of data available.

A point to stress is that all three countries in the BCLME have fisheries that are primarily controlled through a TAC broken down into quotas. Although this is a classic first step in ensuring efficient and sustainable fisheries, it is surprisingly unusual around the globe. The existence of such control systems is genuinely advantageous to any policymaker aiming at bio-economic efficiency. Indeed, the rules and regulations in place across the three countries indicate careful thought and genuine understanding of the fisheries involved.

Despite this, each country in the BCLME has a history of problematic economic contracts. In Angola the EU had a contract that allowed access to Angolan waters for a flat fee, but with no limit on the catch, only a coarse control on the allowable effort in the form of a restriction on the number of vessels. The profit maximizing response to such a contract is to use large vessels, deploy as much gear as feasible, and fish as intensively as possible, trans-shipping to cut the fishing down time. Add that the EU vessels had a poor history of record keeping, and the contract was little more than an invitation to mine the resource. The contract was

terminated recently, but some of the new bilateral contracts that have replaced it also have problems. Every contract has strengths and weaknesses; the EU agreement meant that European fishermen bore the entire risk that the fishing season would be poor, but only for the two year life of the contract. One of the new agreements with Chinese investors to use Chinese vessels in exchange for 70% of the catch made by those vessels means that the risk of stock collapse is now shared by the local partner. On the other hand the agreement is longer term and involves a local partner who has an interest in the sustainability of the resource. Harvesting practices should therefore be more sustainable.

Historically Angola's horse mackerel resource was exploited by Russian and East European fleets. Many of these vessels are now operating in Namibian waters. The control of mid-water trawlers, and in particular of their impact on the more valuable hake resource, requires careful design of contracts. The Namibian permit conditions, for example, restrict the depths in which mid-water trawlers can operate. By keeping the vessels to deeper waters the managers of the resource intend to prevent them from targeting hake and also to keep them from depleting stocks of juvenile mackerel. A more controversial contractual feature that comes out of the Namibian permit system is the separation of quota for a given species according to the harvesting technology. The separation of the hake TAC into freezer-vessel and wetfish quotas is intended to secure jobs in the industry. As with other interventions it seems likely to have unintended consequences: it has become clear that this separation is effectively imposing a tax on the industry and reducing its profitability. Conventional economic theory argues for efficiency and equity as features of taxes – the question to be asked before policies like this are introduced should be, 'is there a more efficient way to create jobs'? Maximizing the profitability of the industry, taxing the profits conventionally, and then using the tax revenues to create employment, is the standard approach. Only where the ability of government to deliver is in doubt would economics ordinarily recommend distorting the industry to achieve the same ends.

In South Africa the fishing industry was historically extremely concentrated: a small number of large operators dominating most of its sectors. The relationship between the state and the industry since 1994 has largely focused on inducing changes to this industrial structure. These adjustments to the industry have not been costless. Fishing and fish processing are sectors that often demonstrate economies of scale and scope. Big firms and vertically integrated firms are typically able to operate at lower cost and with less financial risk than small operators. The reallocation of permit rights from large to small firms, combined with requirements that new entrants actively invest in the industry, have raised the overall economic risk profile of the industry in South Africa. Persons with fishing skills wishing to enter and obtain quota have had to commit personal capital or enter into debt to meet the permit conditions. They are consequently both more exposed and less resilient than established participants. The political imperative for Black Economic Empowerment, combined with the inherent volatility of fish stocks and fish markets, and lately the rising operating costs of vessels, may clearly have unintended and unfortunate consequences. These may be magnified or diminished by the contracts in place between the state and fishing companies, and the rigor with which they are enforced.

The joint governance of the Benguela Current Ecosystem by the three states involved also sets challenges. The collapse of the pilchard stock in the Northern Benguela has been attributed, in part, to heavy fishing of this pelagic resource on both sides of the border, with Namibian trawlers fishing in Angolan waters after the Namibian stock collapsed. The principle that trawlers should follow fish, and that the stock should be treated as a single entity irrespective of borders, is admirable. The lesson of the Northern Benguela pilchard resource is that, *even if the underlying permit conditions and contracts are sound*, international co-management for bio-economically efficient joint exploitation is only feasible if

the stock assessments underlying it are solid. The foundations of a three country joint stock assessment programme already exist, and the necessary scientific foundations are in place. What is further needed is the cooperation of the three governments involved, and of the fishing industries in all three states.

In making recommendations for a rights based system in the BCLME it seems clear that there is little immediate need for major changes: the current systems of rules and regulations are generally sound. There is room for marginal adjustments, but in general the regulatory regime is sound. Unfortunately a regulatory regime is only as effective as the science underpinning it and the compliance of those who use it. The monitoring of and systems of penalties for non-compliance are the areas in which the greatest potential for improvement lies. Probity and effort in administration and enforcement are prerequisites for efficient and working contractual systems in any fishery. Given these, and a stress on the co-management of the resource by industry and the state, the socio-economic contributions of the Benguela fisheries could be restored.

Note: this document was written to accompany BCLME project LMR/SE 03/03, The *BCLME Commercial Rights Holder and Vessel Analysis* and its accompanying database.

TABLE OF CONTENTS

1. INTRODUCTION

Angola, Namibia and South Africa have very different histories of monitoring and managing fishing resources, are at very different stages of economic development, and have different degrees of openness to foreign involvement in the industry. Prior to independence in 1990, Namibia's waters were managed by an international body, ICSEAF, which resulted in widespread over-fishing. In South Africa the Cape Province was responsible for setting fisheries policy up until the 1940s, but the provincial authorities lacked the financial muscle to develop the fisheries. Today, the fisheries acts in both Namibia and South Africa place the responsibility for managing fisheries policy at a national level, and grant the Minister wide discretionary powers in setting fisheries policy. The Angolan process is more opaque, but also appears to grant the minister wide discretion. Trans-country management is currently limited to the management of the tuna resource, although Namibia and South Africa are both signatories to various international agreements, and the Angolan resource, since the non-renewal of the Angola/EU fisheries agreement, is exploited through a system of bilateral international agreements.

In all three countries the management process is in a state of transition. Namibian policy is arguably the most advanced. Since independence in 1990 it has restructured its industry, but is currently grappling with problems of economic inefficiency and overexploited resources. South Africa is in the process of restructuring its industry, and inadvertently encouraging overcapitalisation. It has yet to test the economic viability of its solution, which involves broadening of access. Angola is just starting out on its transformation, but government assistance to develop local fishers runs the risk of engendering a boom/bust cycle similar to the one South Africa experienced in the 1950s. In all three countries poorly designed contracts have the potential to exacerbate economic difficulties and to lead to unsustainable outcomes.

The substantial differences between the three countries make it difficult to implement a simple, transparent and consistent approach across them. Instead, it seems more plausible that each country will tailor contracts to meet its own specific needs. Such a country-specific approach will have implications both for BCLME-level efficiency and country-level efficiency, especially since economic theory suggests that simple and transparent rules (well-defined and transferable property rights) are necessary to allocate resources efficiently.[1]

This report analyses the contracts and permits involved in the management of the following species: Large pelagics, small pelagics, mid-water trawling (horse mackerel), rock lobster, hake, and deepwater red crab. It examines the effort controls put into place for these species in each country, the relative success of these management regimes to date, and the expected outcomes. A short summary of various management regimes around the world, and their relative successes in preserving stocks and increasing efficiency, is included in the appendix.

This paper includes an examination of the mechanisms available to manage a fishery given diverse management goals, and explores the difficulties of contractual design in a fisheries context. It examines how the efficiency of a set of contracts may be assessed and the informational requirements for such contracts to be successful. It looks more closely at the actual set of contracts in the BCLME and evaluates them in terms of economic and information efficiency. The paper concludes with an assessment of the possibility of an integrated management approach to the three fisheries.

[1] The importance of fisheries in the economy also differs between the three countries. See Thorpe *et al's* (2005) discussion of the importance of successful policy as the centrepiece of a development plan.

2. FISHERY AIMS AND CHALLENGES

Table 2.1. Fishery Aims and Challenges in the BCLME

Country	Challenges	Aims in Rights Allocation
South Africa	1. over capitalization 2. large number of quota holders 3. large artisanal fishery 4. over fishing 5. high-grading 6. lack of scientific knowledge regarding fish stocks 7. regulations which impact on efficiency in production	1. biological sustainability 2. ecological considerations 3. transformation and black empowerment 4. socio-economic considerations (food security)
Namibia	1. exchange rate – too strong Namibian dollar 2. high fuel prices 3. lower fish prices 4. quota conditions which promote over fishing and waste 5. collapse of some stocks such as pelagics	1. rebuild fish stocks by basing management policies on sound research; 2. use taxes and levies to induce Namibianisation 3. use fishing rights allocation to empower previously disadvantaged Namibians.
Angola	1. difficult business climate, corruption 2. lack of infrastructure 3. over fishing and stock collapse (pelagics) 4. lack of monitoring 5. lack of scientific knowledge regarding fish stocks 6. large artisanal sector 7. conflict between artisanal and industrial fishers.	1. promote development of artisanal fishery, industrial fisheries sector, aquaculture, and salt production, promotion of a reliable supply of fishery products to the population, maximization of benefits from responsible use of living aquatic resources. 2. guarantee rational exploration of the aquatic biological resources inside the limits of biological sustainability and to protect the aquatic environment. 3. legislate to protect aquatic biological resources and to guarantee their application. 4. create enabling mechanisms and financial and fiscal conditions. 5. promote training, capacity building and development of expertise in the fishery sector 6. promote improvement of the economic infrastructure and social basis of the sector. 7. relieve poverty, reinforce food safety, improve the standard of living, promote fish supply, and maximize income from fisheries

As can be seen in the table above, common problems in the fisheries include over capitalisation, unsustainable over-fishing, and a lack of monitoring. Rights allocation systems have a direct effect on fishers' investment decisions, and on whether they view their participation in the industry from a long-term or short-term perspective. Fishermen who do not regard their participation in the industry as a long-term commitment will not be willing to pay for monitoring and scientific research, and will prefer the short-term benefits attached to over-fishing, as opposed to the long-term benefits of managing the resource in a sustainable way. It is well known that fishermen in open access fisheries will harvest or exploit the resource until their marginal private benefits equal their marginal private costs, resulting in over-exploitation of the resource and dissipation of rents. Similarly, rights holders who are not assured of reaping the benefits of their own conservation efforts in the future may choose to over-exploit the resource immediately. Without cooperation, monitoring and coordination of effort, competition between fishers leads to over fishing!

3. THEORY OF EFFORT CONTROL

There are a number of mechanisms or contractual arrangements available to a national government that can affect the structure of the industry. The literature distinguishes between restrictions on entry and effort (who is allowed to fish), restrictions on catches (how much can be caught), and restrictions on how to catch (what gear and effort can be deployed), although fisheries are often governed by a mixture of all three forms of control. Absence of restrictions is of course also a management regime and here each individual would have an unrestricted right to catch an unlimited amount of fish. Economic theory suggests such an outcome is unlikely to be efficient, and that fishers will over-invest in the fishery.

The contracts in place between harvesters and processors, processors and retailers, as well as companies and their employers and companies and their financers can all affect the manner in which the resource is harvested. For example, historically South African pelagic and demersal enterprises evolved to be financed by powerful parent companies. This allowed the fisheries to weather short-term fluctuations in quota and economic conditions, and take a longer-term view on the resource.

It is clear that there are major differences in the contractual arrangement governing firms in Angola, Namibia and South Africa. Prior to 1994, South African companies tended to be larger and vertically integrated. This has changed somewhat as access has been broadened, particularly in the harvesting side; also, as companies increasingly target lucrative foreign markets, they have as a consequence outsourced their retailing components. This trend towards foreign partners is even more pronounced in the export-dominated Namibian industry where foreign companies often hold an indirect stake in the company, despite strong incentives for Namibian companies to catch and process fish. Angolan firm-level contracts also show patterns of international investment, historically with Eastern European, and latterly increasingly with Spanish and Chinese enterprises.

In both Namibia and South Africa the State has intervened to shift the structure of the industry from what it was, or would be if economic efficiency was the most important criterion in allocating resources in a fishery. The most obvious means of intervention is granting certain individuals the rights to harvest or process the resource and restricting others from these rights, but it will be shown that there are other means whereby transformation can be achieved.

3.1 What contractual arrangements are available?

The first point to stress is that it is not just the contracts between the state and the fishing enterprise that drive the economic efficiency and sustainability of the fishing industry. Contracts that impact on the rate and manner of exploitation of the resource extend throughout the production chain. A fishing company can choose between a fixed-rate and a performance-linked contract when it employs labour. Typically, crew (and vessel captains) earn a package that is part fixed, but also determined in part by performance – in other words by the value of the catch. This form of contract not only stimulates fishing effort, but may also predispose to high-grading, fishing in closed areas, use of unacceptable gear and similar contravention of conservation-based regulations.

Where processors buy-in catch, their contracts with fishers can shift the risk of non-delivery forward (to the processor) or backward (to the fisher). Where there is monopsony power in the industry the latter is likely to be the case. Again such a contract predisposes to illegal harvesting of the resource, and can disempower fishing rights-holders.

Contracts between processors and foreign buyers are valuable and lie at the heart of the global commodity chain. Where non-delivery threatens the security of such a contract there is an incentive for the processor to try to circumvent the problem. This can be achieved by importing product for re-export. Thus, in the hake industry, Argentinean hake is used as input in the South African industry; it has also happened in the pilchard and horse mackerel processing sectors, where local firms have imported product from firms elsewhere in the BCLME zone. This means that long term contracts in one area can impact on harvesting rates elsewhere.

There is extensive literature documenting the international experience with a number of different regulatory regimes. Much of the concern of this literature is in devising regimes to cope with problems of over-capacity and overexploitation. Although there is a growing view that Individual Transferable Quotas (ITQs) are likely to result in economic efficiency if backed by adequate monitoring and suitable penalties for contravention of regulations, there is also literature on their points of failure and on the many alternative means of fishery regulation.[2] Currently they are only a feature of the policy regime in Angola, where the monitoring capacity is the weakest of the three BCLME states. South African individual quotas are unofficially tradable, as are Namibian ones - Namibian quota that is likely to be unused may also be returned.

The literature distinguishes between technical controls, input controls, output controls, and various subsidies and taxes. Output controls (quotas) most closely resemble property rights to the resource, and encourage economic efficiency in the fishery. Free market economists therefore often favour them as their instrument of choice. The chief objections to ITQs have been their effect on employment and equity. The introduction of ITQs favours cost-efficient producers, and typically decreases employment in a fishery. [3]

3.2 Technical controls (gear restrictions)

Technical controls take forms such as minimum mesh size, approved gear type, closed seasons, and closed areas. They were initially advocated by biologists trying to target Maximum Sustainable Yield (MSY), or in belated attempts to conserve already overexploited stocks (by protecting spawning stock, limiting damage to the ecosystem, etc.). These may be the most appropriate intervention when the state of the stock's biomass is unknown, or when monitoring is expensive.

While technical controls can be relatively easy to enforce, they may encourage rent-seeking behaviour on the part of fishers (by excluding alternative gears fishers may hope to entrench their own positions); they can also protect inefficient means of fishing, and ignore economic incentives driving fisher behaviour. However, they can be used to preclude the worst 'prisoner's dilemma' scenarios by outlawing certain forms of behaviour. Technical controls such as regulation of bottom trawls to minimise their effects on the seabed, or restricting the use of long lines in recognised breeding areas, can coerce a profit-maximising fisher to fish in a 'socially acceptable' manner. Such controls could form a basis for ecosystem management by restricting destructive gear forms uniformly across the BCLME.

Short-term profit maximising and long-term optimality may be at odds with one another. Short-term optimality can impose external costs, not only on other fishers at present, but also on future users, including the fisherman himself—an extended form of stock externality. This would be problematic in two particular long-run cases: where the fisher's knowledge of these external effects is incomplete, and where the private and social rates of discount differ.

[2] See FAO (2001) for an exhaustive study on transferable quota rights in 23 different fisheries.
[3] Eisenack *et al* (2004) provides an overview.

There are no uniform technical controls across the BCLME. This has implications for the efficiency of the respective fleets. It also has implications for the joint management of the resource. Certain straddling stocks between Angola and Namibia, for example, have different closed seasons. Stocks are also fished by different forms of gear, e.g. both the purse-seine fleet and the mid-water trawl may target horse-mackerel, the former as adults and the latter as juveniles. Optimal management has to recognise this and its implications.

3.3 Input controls or Effort rights

Input controls aim to control harvest in fisheries by restricting effort inputs that go into fishing. Their effectiveness is limited, as it is difficult to control all inputs. The regulators' problem is to monitor efficiency creep as fishers have an incentive to circumvent the controls. This increases the information cost on the solution, which may need to be very tightly specified. It may also be difficult to ensure that all restrictions are being adhered to. Effort controls need to be combined with other restrictions, otherwise we may see much time being wasted on simple circumvention of the controls. Once again, resources are wasted ensuring restrictions are adhered to and finding ways to get around restrictions.

Inputs that can be controlled include the length of the vessel, the length of the trip, and the horsepower of the boat. Input controls promote inefficiency in a fishery by distorting the input mix; they also generate outcomes that can benefit certain input suppliers.[4]

Effort controls are preferred when monitoring costs are high, there are many participants in the fishery, and it is difficult to forecast the biomass of the resource. Such an approach is typically most applicable to inshore fisheries where other forms of control are difficult to implement. South Africa has used effort controls in a number of fisheries, although this is more applicable to East Coast fisheries. Namibia currently uses effort control in certain of its fisheries (monkfish). Where fishing technology is relatively uniform, effort controls may be a good solution.

3.4 Output controls

These take the form of restrictions on the amount of fish a rights-holder may catch, and most closely resemble an actual transfer of property rights to the resource. The right is usually in the form of a percentage of total allowable catch (TAC), which can vary from year to year. Quotas are usually allocated on a species-by-species basis, because modellers often work on a single species basis and to preclude targeting of valuable by-catch.

The life of a quota can vary from one season (or less) to perpetuity, and quotas can be non-transferable, transferable or inheritable. Inheritable rights tend to be rights to fish rather than quota, and are typically applied to artisanal fishers (e.g. trek fishers in SA). For quotas to allocate resources efficiently they need to be freely transferable so they end in the hands of the most efficient user. Quotas can be difficult to monitor, especially at sea. This can encourage high-grading, where fishers discharge inferior quality fish (typically juveniles or low value catch). However, technical costs of monitoring are falling, and eventually 100% monitoring is likely (as is currently the case in Namibia).

There is certainly circumstantial evidence of high-grading practices in South Africa, where monitoring is incomplete.[5] Spreading the TAC too thinly may mean economically unsustainable quotas; these may lead to high-grading as a matter of economic survival. An

[4] Boyce (2004) describes how sub-optimal instruments can be adopted because they benefit particular interests.
[5] See Japp (2002).

export market that pays a premium on a certain size of fish may also encourage high-grading. Even well-established players could face an incentive to high-grade if their processing factories required a certain size of fish to operate optimally.

This practice appears to be less of a problem in Namibia where there is 100% vessel based monitoring and where fishers are struggling to fill their quotas. However, this does not mean there is not an economic incentive to high-grade in Namibia, but that those who do high-grade may land a higher value catch, but will have expended extra resources on catching those fish.

Angola is in the process of revising its fisheries policy. Prior to 2004 EU fishing vessels were allowed to fish in Angolan territorial waters. Monitoring of these vessels was poor and their overhead costs were high (due to the distance from homeports); consequently these vessels had a strong incentive to high-grade. This incentive was exacerbated by the short-term nature of the contract, especially as there was no quota limit, and the fear that it would not be renewed.

Quotas also ignore the problem of by-catch. By-catch is an unavoidable consequence of fishing, but fishers can also target by-catch in an effort to boost returns. Namibia has by-catch restrictions on most commercial fish, with substantial fines if these targets are exceeded. The consequences of these fines on this type of fishing are hard to gauge, but it is unlikely that the incentives have been chosen to optimise efficiency.

A further difficulty with quotas is that they are based on a single-species management. There is only a limited extent to which quota can be extended to more than one species.[6] Of course, firms could be given individual species quotas with the allocations based on ecosystem-based modelling. Giving an individual species quota holder incentive to fish in an ecosystem-sustainable way is difficult. Economic theory would suggest that the property right needs to be vested in the ecosystem rather than a single species for this to occur. South Africa is committed to an ecosystem based management regime by 2010.

3.5 Individual Transferable Quotas (ITQs)

Amongst output controls, the most discussed are ITQs. A benefit of ITQs is that they provide a market for fishing rights. If the market is competitive, we can assume prices will settle to ensure the most efficient allocation of goods between buyers and sellers. The more like a property right an ITQ is, the more owners of the right can operate efficiently. ITQs enable rights holders to catch fish more efficiently, improve the size or quality of the catch, sell the catch at the best possible price, improve their safety record while at sea, reduce transaction costs, and reduce the risk of being dispossessed of the right to exploit the resource (Lindebo, 2001). One problem with ITQs is that they are not self-enforcing, although if rights are durable, owners can be expected to support a joint monitoring system.

The quota allocation system is often also a source of contention. ITQs are valuable and saleable rights. Effectively an ITQ is a tradable claim against a portion of the nation's resource base. Once traded they should move to the most efficient producers, but on the way will provide a cash windfall to those who initially receive them.

One way around the problem is to auction the quotas; the rent then accrues to the state. This presents a problem as new entrants, lacking information on costs in the industry, may under- or over-bid. A solution in a secret tender system is to take the second highest tender, in an

[6] South Africa has attempted this with a 'joint' quota for sardine and anchovy, but the resulting allocation between firms has been found arbitrary by the Supreme Court of Appeal. See the judgement in favour of Foodcorp (2005).

attempt to prevent firms overbidding to secure the contract.[7] An alternative method of allocation is 'grandfathering', where the initial allocation is done on the basis of previous participation in the industry, typically on previous catch history. In the context of a depleted fishery, the individuals who overexploited the resource most extensively would be those rewarded with the greatest future rights. This creates perverse incentives if fishers anticipate the future introduction of ITQs. It is also problematic in cases where historic access has been skewed away from certain groups in society.

The initial allocation process in ITQs is very sensitive, and may be very costly to achieve in a non-controversial way (Lindebo, 2001). The allocation process often depends on catch history, vessel length or some other capacity measure.
ITQs which are durable will cause a more long-term approach to be taken by quota holders, especially in terms of investment and in conservation of the resource. As ITQs are generally allocated as a percentage of the TAC, if stocks are not conserved all quota holders will suffer. Uncertainty in the allocation process and short permit life will reduce the advantages of ITQs.

If quotas are transferable, undesirable socio-political outcomes may occur. Often socio-economic or political aims in fisheries are at odds with economic efficiency aims. Low cost producers in an ITQ system may threaten the livelihoods of small scale fish producers, especially if quotas are fully tradable; however this has not always been found to be the case (Lindebo, 2001). Tradability of quotas may include such restrictions as whether the quota can be divided, whether official approval is required to transfer the quota, whether monopolisation of quota is allowed, whether the transfers are permanent or temporary, in which regions they are allowed and so on (Lindebo, 2001). Socio-economic concerns in fisheries may take precedence over efficiency, in which case we may see distortions in the market, which may be permanent or temporary.

We may also see minimum or maximum holding restrictions on quota, in order to prevent too much splintering or too much concentration in the industry. A more concentrated industry may be able to operate more cost-efficiently, but may impact on small scale fishers' livelihoods, while a more splintered industry may reduce the ability to monitor catch, and may increase pressure on TACs.

Another issue concerning ITQs is how the price for the quota is set. Prices should signal buyers and sellers as to the conditions in the market, and be at levels that just clear the market. If quotas are tradable, a market for them should emerge. However, initially governments or fishing ministries have to decide on issue prices for them, unless they let quotas be publicly auctioned. Evidence has shown that quota prices tend to increase over time, in situations where they are tradable. This may imply a windfall gain for initial quota holders, who may therefore expend resources attempting to gain quotas without intending to use them, but clever management of quotas can extract these rents (Lindebo, 2001). High prices also reflect scarcity of resources and the capitalisation of most fishing industries.

As has been mentioned, the allocation of quota may be a sensitive, and consequently a costly process. To meet these costs many fisheries ministries levy administration fees on quota owners, often as a percentage of landings value. Another issue is who should participate in the quota allocation: just current industry participants, or also those who would like to participate in the industry (Charles, 2002). National policy may also drive management decisions, especially when nations have undergone significant political change, as have all three BCLME countries since 1990.

[7] See Stoneham *et al* (2005) for the usefulness of auctions in allowing governments to estimate firm costs.

High-grading and high levels of by-catch can occur in ITQ-based fisheries, as they can under other management regimes. There may also be incentives for fishers to under-report catches. If many ITQs are allocated and trading does not occur, there may be pressure on fisheries management to increase the TAC. ITQs and other types of harvest rights may be best used when gear in an industry is very heterogeneous, or when there is a solid knowledge of fish stocks' status.

While ITQs are individually allocated, some fisheries are localised and have a communal history. Charles (2002) asks whether use rights should be instituted at the individual or the collective level. Generally the choice depends on historical factors, and the policy objectives currently being considered. Policy initiatives may favour targeting individuals in order to achieve certain aims such as equity or localisation of an industry. Collective rights have been seen to be most often associated with long-lived and well-managed traditional fisheries. However, collective rights systems cannot work with every fishery, and need to blend in with existing social frameworks in communities. The larger a community, the less cohesive and well-defined, and the less experienced in fisheries, the more likely a collective rights system is to fail. If a collective rights system can succeed, it can also succeed in guaranteeing the continued existence of communities (an issue in places such as Newfoundland, where the collapse of the fisheries resulted in the relocation of many communities).

Territorial use rights fisheries are a good example of collective rights. Territorial use rights in fisheries (TURFs) assign rights to individuals or groups to fish in certain areas, according to long-standing traditions of division and management (Charles, 2002). Examples of these types of use rights are wide-spread, and often include excellent models of resource management. Examples of TURFS include artisanal fisheries in Chile, lagoon fisheries in the Ivory Coast, beach seine net fisheries on the West African coast, shellfish and seaweed collection in South Korea and Japan, and many others. Very often in areas where TURFs are assigned, successful local solutions are found to problems which occur in management of the resource.

These are examples of successful sustained cooperation in the prisoner's dilemma game of shared resources, which result from a few factors. Repeated interactions often encourage cooperation, as the interaction is viewed as long-term, and thus there is no point in over-exploiting in the short term. Two further factors that help in this regard are reputation (if I don't cooperate and I over-exploit the resource, my rights to do so will be taken away) and the localised nature of interactions, which ensure that defectors are easily found and punished. Often these systems also fit into the framework of existing social interactions in a community (Charles, 2002). Many of these systems have fallen by the wayside as fisheries become commercialised, but they are still a very effective way of providing local communities with productive livelihoods, and conserving fish stocks. TURFS may be very amenable to management of sedentary fishery resources.

Limited use rights or limited entry involves management of fish stocks, by restricting the number of vessels and/or crew involved in harvesting the fish stock. They are a form of effort control, and do not solve the problem of managing the behaviour of the existing fleet, but only control how big the existing fleet can be. Without being combined with other restrictions, such as output or effort or gear restrictions, limited entry rights will not succeed in the conservation of fish stocks. They will just limit the number of players who share the profits of the fishery. In limited entry systems there is still an incentive to race to capture the surplus fish available, and we may see unsafe or improper methods used to capture fish before competitors do (Charles, 2002). Over-capitalisation may also be an issue in a system such as limited entry. Another problem with limited entry is selecting the correct number of

licences. If too many are allocated initially, it will be very difficult to reduce the number later on.

In a system of use rights, the duration of the rights is an important issue. If their duration is short, they may be reallocated more frequently. Longer-term rights encourage optimal levels of investment and conservation, and provide more of a feeling of ownership of the resource to rights holders. Longer-term rights may involve a very lengthy decision period, in order to agree with as many aims of the fisheries policies as possible. It should be possible to introduce some flexibility into the system, as long as conservation of the resource is not impacted on. Note that in Namibia rights of varying durations are often allocated to the different participants in a single fishery. If stocks recover well as a result of conservation, it may be possible to introduce a few more small rights holders, without reducing the absolute shares of other participants. In formal terms, a 'Pareto improving' allocation is possible, if the overall pie is growing.

Allocation mechanisms include: the use of auctions, examination of catch history, equity principles, using an allocation panel and community or group allocations (Charles, 2002). A lack of information can preclude the use of auctions as an efficient allocation tool, as can social concerns. Catch history alone should not be used, as this creates incentives to over-fish in order to gain quotas, and also encourages overcapitalisation. An alternative to auctions is allocation on the basis of a set of socio-economic criteria, as is done by allocation boards in South Africa.

The transferability or tradability of rights is an issue to be considered. Rights can be completely non-tradable or transferable; non-tradable rights become null and void if the fisher leaves the industry. Other possibilities are non-divisible transfer between fishers, divisible transfer of use rights, with free selling and buying, transferability only to existing participants in the fishery sector, or any sort of hybrid approach (Charles, 2002). Limited transferability provides useful flexibility, but may distort the original goals behind the allocations of the rights. This is not necessarily problematic. Thus, totally non-transferable rights that are allocated geographically to coastal communities, while providing stability for communities also reduce the mobility of community members.

If rights are non-transferable, the quota system will not maximise the industry's efficiency. However, goals for the industry may not just include a wish for a few very efficient producers, but may also include a desire for a productive fishery which meets an alternative agenda such as providing employment to local communities. If the TAC is set with a view to fish stock conservation, and rights are then allocated with a social objective in mind (such as maximising employment), then non-transferable quota can be a desirable tool, despite not yielding the lowest cost outcome. Where the state is an efficient provider of infrastructure and employment, maximising industry profits and then taxing them is a sensible policy. If, however, the state's ability to deliver jobs etc is limited, then inducing industry to do so is a sensible second best policy. One proviso before distorting an industry's performance in this manner is that research funding must be certain if fishing industry profits are ordinarily taxed and set aside to fund the research and administration of the industry - fisheries may not be able to provide the surplus needed to pay for scientific research, monitoring and enforcement if forced to operate inefficiently. This concern is relevant in both South Africa and Namibia, both of which earmark fisheries levies to fund research and administration costs.

3.6 Subsidies and taxes

In a perfectly functioning market, prices reflect society's preferences and consequently keep the needs (and interests) of producers and consumers aligned. Where markets are imperfect, the interests of these two groups can theoretically be realigned by use of subsidies or taxes. An example is the case of overexploitation in open access fisheries. A tax on the fishery would reduce the overexploitation, and transfer the rent gain to society at large.

Even with well-specified property rights, inefficiency can follow from informational asymmetries and uncertainty. An example is an ITQ market that does not trade frequently, or where information about the nature of the resource is poor. Here the price of the quota may not reflect its true social cost (either too high or too low); a tax or subsidy could be used to shift the price of the resource towards its true social value. This presupposes that the state has better information than the market. If this is not a valid assumption any tax may itself simply distort the market, and decrease international competitiveness, while a subsidy would merely give the state trouble with the World Trade Organization. A further problem of subsidies is that they are clumsy, slow to react to changing circumstances, and lend themselves to rent seeking.

Neither Namibia nor South Africa has direct fishing subsidies. Given the inherent volatility of the industry this often necessitates ownership by well-endowed or heavily diversified parent companies. Efforts to empower small companies may be unrealistic. Small companies are likely to remain marginal players, and have an incentive to overexploit the resource. Angola is moving towards developing local industry. An aspect of this move is effective subsidy of small semi-commercial fishermen, and infrastructure development. These may put pressure on the resource, especially if the regional economy in the south remains depressed. The experience of most countries throughout the world suggests local subsidisation of industry runs the real risk of developing overcapacity. This was the experience of South Africa in the 1950s where concerted efforts were undertaken to develop the pelagic industry.

The South African industry currently has an indirect subsidy in that the costs of managing the resource are partly subsidised by the general taxpayer. There is a move towards recouping the full costs of managing the resource. In Namibia, the full costs of managing the resource are charged to the entity that catches the resource (and not the rights-holder). However, recent difficulties in the industry have forced the minister to offer some relief to the industry (higher quotas than would otherwise be the case and some leeway on levies).

3.7 What is inherently difficult about fisheries contracting?

Free-market economists often argue that the difficulty in managing marine resources efficiently (both trans-boundary and country-specific) is that assigning exclusive property rights to them is expensive. Open access (i.e. absence of property rights) and the perverse incentives arising from it dominated the early literature on the economics of fisheries.[8] A point on which there is broad consensus is that open-access fisheries are inefficient.

One reason for the non-assignment of rights to marine resources is that such rights are too costly to enforce. Even demersal fisheries face incomplete information (the number of fish is unknown) and asymmetrical information (the fishers have a much better idea of what is being caught than the authorities do). This increases both the cost of enforcement (monitoring and sanctioning) and the incentive for countries or individuals to free-ride on any arrangement.

[8] See Gordon (1954).

Difficulties with enforcing contracts also apply to resources that are cheap and easy to access – such as high value inshore species like rock lobster. Here policing costs can be prohibitive and the cost of entry to the fishery low. Such fisheries are vulnerable to biological overexploitation, particularly if the resource is slow-growing and limited opportunities exist elsewhere in the economy.

An additional complication is that most fisheries administrations have objectives beyond simple economic efficiency. Theory suggests that Individual Transferable Quotas (ITQs) are the most efficient contracts economically, but secondary aims can hinder the implementation of transferable contracts. These goals make appropriate contracts more complex, less compatible with economic incentives, and more vulnerable to opportunistic behaviour.[9] The most obvious form of opportunistic behaviour is when firms embark on rent seeking in order to obtain contracts. Such behaviour acts as a tax on firms and harms economic efficiency.

Contractual difficulties in fisheries do not only exist between the state and the rights holder. In certain fisheries there are strong incentives to integrate vertically because the market mechanism does not work adequately between harvesters and processors. This is particularly true of capital-intensive fisheries like deep-sea hake where harvesters would not be willing to make the capital investment for fear of being squeezed by processors. This 'hold-up' problem occurs whenever there is power asymmetry along the production chain and is overcome when the same party harvests and processes the product. Intervention in a fishery to break up this 'monopoly' may inadvertently put small independent harvesters in an impossible position as they are held to ransom by powerful independent processors or foreign buyers. South Africa has tended to focus on broadening harvesting access, perhaps without due regard to the structure of the industry.

The price mechanism's co-ordinating role can break down when firms have market power.[10] Certain sectors of the fishing industry enjoy both economies of scale and market power, consequently transferable property rights do not necessarily lead to allocative efficiency (i.e. economic decisions that maximise social welfare). The issue is not, however, clear-cut. The oligopoly sectors of the industry in the BCLME, in particular processing and marketing, but also such capital intensive fishing sectors as deep-sea hake trawling, do enjoy market power.

On the other hand, their oligopoly situation is a consequence of economies of large-scale production. In comparison to small- and medium-scale enterprises, such firms are able to produce and market their products at lower cost, are better able to sustain short term losses, can offer more secure contracts to workers, and are better situated to market their products internationally. They may also be cheaper and simpler to monitor and may have a more profound understanding of the long-term consequences of fishery practice. More to the point, these firms are largely export-based, and any market power here is a 'good thing'.

A competitive open access or fugitive stock harvesting industry can force firms to be risk-takers (if they don't catch the fish their competitors will), and encourage firms to overcapitalise their fleets (adopt a new technology so as to catch fish ahead of the opposition). Political realities can make it difficult to revise a TAC downwards when some operators are economically marginal; moreover, such marginal players have an incentive to catch fish illegally. In contrast, a monopolist is likely to have a more conservative approach to harvesting the resource, regardless of the information set.

[9] See Milgrom and Roberts (1992) for an easy introduction.
[10] This result is well documented. See, for example, Milgrom & Roberts (1992).

3.8 Sub-optimality of Open Access

For biologists, open access is inefficient because it does not encourage the resource to be harvested at its maximum sustainable yield. Economists argue open access is inefficient because it does not maximise economic rent. Policy makers argue that open access is inefficient because it does not optimise their objective function (which typically includes biological, economic and other criteria). An open-access regime can decrease the chances for co-operation, particularly if new entrants enter the fishery. It is also vulnerable to technological change, as the resilience of the resource will not necessarily be able to cope with improvements in fishing capability.

3.9 Insights from theory

Graham (1935) stressed the difficulty fishers had in reaching agreement amongst themselves. He argued that fishers had a tendency to overcapitalise their boats and overexploit the stock, despite ultimately being collectively worse off, because each had to adopt new gear as his rivals did. This is a classic prisoners' dilemma: their inability to contract among themselves results in the fishers all being worse off.

Graham's analysis took as given the inability of fishers to agree amongst themselves to restrict the sort of gear they should use, presumably because the incentive was too great to adopt new gear. His solution was to call for international agreement to limit the season or restrict the gear.

Gordon (1954) drew attention to the inability of technical regulations (e.g. gear restrictions) to efficiently address overexploitation whenever exclusive property rights were absent. His analysis suggested that under open access the incentive is to *compete* for economic rent rather than to *maximise* the total amount of it. The result is effort that is extended beyond the socially optimal.

Gordon defined optimality in economic terms (rent maximisation) and not biological terms (maximum sustainable yield). Gordon argued that fishers would not have an incentive to harvest at MSY because they would not be maximising profits at that level, unless, by chance, CPUE was unrelated to the stock size.

Scott (1956) took this analysis further and argued in favour of monopoly exploitation of a given fishing ground – in effect restricting access to just one entity in any geographic zone, and thereby eliminating the incentive to over-fish because property rights were poorly defined. Such an outcome was only feasible in industries with high barriers to entry – such as the deep-sea hake industry in South Africa. As access to the resource broadens, the risk increases that firms will no longer have an incentive to manage the resource responsibly. The widespread installation of vessel monitoring systems (VMS) may make this once again a feasible management system, especially when used in conjunction with long term rights.

Despite these issues, from an economic efficiency point of view open access (i.e. unlimited access) remains the appropriate management strategy whenever the gains that arise from allocation of exclusive rights to the resource are less than the costs of enforcing them. Following this institutional evolution line, a free-market theorist, Demsetz (1969), argued that arrangements that allow enforcement of private property rights should emerge provided this is financially feasible, such as what occurred in the San Francisco crab fishery. The policy inference is that the state regulators need not intervene to correct for a market failure.

The riposte to this free market view is that monitoring and enforcement may be cheaper for the state than for the private sector. The state may be better able to cope with incomplete and asymmetrical information, things which make it difficult for private parties to contract amongst themselves. If so it may be economically rational for the state to impose a solution onto the market, since the market would not generate such an outcome unassisted. This approach is also supported in the game-theoretic literature where an external coercive force is often needed to ensure the stability of a solution. The point here is that the Nash equilibrium is inefficient, but it is the market outcome. An external coercive force has to be used to resolve the impasse.

In addition, the state typically tries to optimise across a bundle of issues that may be individually at odds with each other. Economics, ecosystem sustainability and social stability are three examples. Biological sustainability can be at odds with the rent-maximising solution arrived at by a competitive market; job preservation, and the male/female ratio in the labour force, can impact on corporate profits. The extreme case is that of a private owner who might rationally mine a resource to economic extinction, even if there are well-defined property rights. This could be the case if interest rates are high, harvest costs are unrelated to population density, the resource is slow growing, and there are more profitable opportunities elsewhere in the economy.[11] Here the private operator would rationally prefer to fish out the resource and invest the proceedings more profitably elsewhere.

The simple theory of the profit-maximising fisherman suggests that if the rate of return on capital invested elsewhere in the economy exceeds the rate of growth in the net value of the fish stock, then the profit-maximising management approach is to deplete the stock. In certain cases (low breeding rates, harvest costs unrelated to abundance, depensation etc.) this can lead to a conflict between economic and biological sustainability).

Without state protection, both the Namibian Orange Roughy fishery and the South African Kingklip fishery have the potential to be 'rationally' fished to economic extinction. Of course, the state intervention might exacerbate the problem. The Namibian government's willingness to raise TAC despite falling CPUE suggests a high current time preference (high r). This suggests the public regulator might have a higher discount rate than the private sector in Namibia (particularly in election years), with potentially disastrous implications for the resource.

The state could also object to the employment implications of the private ownership solution, preferring a less efficient but more labour-intensive solution. Again, intervention via the quota allocation system can be used to distort the industry e.g. in favour of labour-intensive land-based processing rather than capital-intensive and labour-saving factory vessels. This has been the case in the Namibian fisheries where a set of levies has encouraged land-based processing, particularly in the hake sector (in addition to distortion through levies, the hake permit is allocated separately for wetfish and freezer vessels).

[11] See Clarke (1973).

4. THE ANALYSIS OF RIGHTS ALLOCATIONS: INCENTIVES AND OUTCOMES

4.1 Efficiency of Contracts

Contracts are the formal or informal agreements between interested parties that govern a set of transactions. In a fisheries context they exist at a number of different levels. Contracts between governments may affect access rights, obligations towards scientific research, and market access. For example, collaborative effort on scientific work exists between the three BCLME countries, in the form of joint stock assessment workshops, Namibian scientists working in Angolan waters, etc. Better known are the contracts, such as quotas and permit conditions, between the state and the harvesters, processors and marketers of fisheries products. These also have a bearing on the overall economic efficiency of the system.[12] Finally, there are contracts between private parties, such as retailers and producers, or workers and employers. These drive the value chain in product processing. This paper will largely focus on the second level contracts between the state and the private sector.

4.2 Efficient contractual design

What loss of efficiency is associated with a set of contracts? All fisheries regimes imply some sort of contractual arrangement or user rights to marine resources. Open access is not anarchy, but a contract giving every individual a right to harvest. A strict command-and-control approach offers rights to a user but restricts the harvests according to the predetermined technical regulations. Anthropologists have documented informal user rights in many traditional fisheries. Each one of these regimes or set of contracts has implications for economic efficiency. An efficient contractual design will increase fisher compliance with broader management goals.

Economists typically ask three questions when evaluating a system or set of contractual arrangements in terms of their informational efficiency.[13]

1) Could the system function efficiently if all the necessary information was available?
2) Is there a system that could achieve the same result with less information requirements?
3) How sensitive is the system to incorrect information?

These three questions set up the basic framework used to evaluate any set of contracts, and will be applied to the set of contracts governing the Angolan, Namibian and South African fisheries. Initially we will focus on the management goals of the various authorities, and establish whether the ensuing set of contractual arrangements is compatible with economic efficiency.

Most economists argue that assigning transferable property rights to a fishery (e.g. individually transferable/tradable quotas or ITQs) is the most effective way to ensure efficiency – since transferable rights will create a market (i.e. price) in such rights, and consequently allow individuals to respond to prices that reflect all available information. A decentralised solution imposes the least information demands on the system - it simply requires individuals to respond to well-behaved prices.[14] In contrast, the centralised

[12] See Sauer W.H.H., Hecht T., Britz P.J., & Mather D. An Economic and Sectoral Study of the South African Fishing Industry, Volumes 1 & 2. Report prepared for Marine and Coastal Management by Rhodes University (2003). Available online at www.envirofishafrica.co.za/projects/ess.html.
[13] Milgrom and Roberts (1992), pp. 93-4.
[14] There are of course informational demands on having 'well behaved' prices, but more on this later.

regulator is required to collect dispersed information in order to devise a coherent plan, and collect difficult to quantify information to monitor that the plan is being correctly implemented.

An important implication for efficiency is that as long as rights are transferable it does not matter to whom these rights are allocated in the first instance. Nevertheless, rights allocation is controversial because it will determine who gets the economic rent from the fishery. The rights to the resource need to be well defined for transferable property rights to allocate effort efficiently in an overcapitalised fishery. Poorly defined (or enforced) rights will not lead to an efficient exploitation of the resource, even if they are transferable.[15] Informational uncertainties and asymmetries can also prevent the most efficient harvester from exploiting the resource.

The starting point in evaluating any set of contracts is to ask, *can the system function efficiently if all the necessary information is available*? Costless and complete information is a necessary condition for the price mechanism alone to clear each market. This is important, because economists argue that individuals responding to well-behaved prices will make self-interested decisions that are optimal in terms of economic efficiency. The presence of imperfect and costly information has serious implications for contractual design and well-behaved prices.

Economic efficiency is just one government policy goal in fisheries management. There are many others: job creation; sustainability; foreign exchange generation; and others. The interesting question is not whether the state's goals are mutually incompatible (as they often are), but what costs they impose on economic efficiency. The literature has tended to focus on the trade-off between efficiency and employment, but goals such as equity (transformation) and biological sustainability are increasingly likely to be important.

The trade-off with efficiency becomes clear if one is looking at the way different things are sold… a charity auctioning an autographed football is only concerned with raising money; the highest price is clearly the best. A state fishery manager allocating ITQs can also do so by auction, but his objective is different, it is less to raise money than to ensure a sustainable, equitable and efficient industrial structure. While it is important that the most efficient firms be able to bid freely, it is also important that new entrants not be precluded from bidding by their incomplete understanding of the resource and the economics of the industry. It is also important that new entrants should not over-bid, i.e. the price paid should not be so high that operators are subsequently forced to mine the stock or cheat on their quotas.

If the 'right' in use is to continue to reflect all available information they have to be tradable. Rights that are allocated once off will not thereafter reflect new information. Consequently they will give little or a distorted signal to firms wishing to enter or leave the fishery.

Internationally many segments of fish product market have become vertically integrated. Processing, packaging, and marketing occur 'in-house'. In the BCLME this is especially true of hake, but also of rock lobster and small pelagic species. The actual harvesting of these species may also tend to be in–house (as with hake), but where high capital costs do not form a barrier to entry, actual fishing is the segment of the industry most likely to appear open and competitive. This creates a problem. In a competitive market profits are typically low in the long run and the market forces price-taking competitive firms to adopt the most cost efficient long run technologies. There is an international trend towards the use of labour saving (capital intensive) fishing and processing - simple efficiency targeting might consequently mean labour shedding in the BCLME fisheries.

[15] This does not mean it is always efficient to define those rights. Demsetz (1967) is the seminal paper.

The use of a quota system that allocates rights to small-scale enterprises is not necessarily helpful if the same producers wish to compete and sell into a well-established processing industry.

A second broad question to consider in analysing a contractual system is, *could one get the same outcome with fewer information requirements?* Economists answer this question by asking whether the set of contracts is consistent with maximising individual self-interest. Information costs are minimised when contracts are self-enforcing, because monitoring and enforcement costs are incidental and have no influence on fishing behaviour. Such contracts are achieved when they accord with the individual's self-interest (this includes both the benefits of compliance, and the expected penalties associated with non-compliance, the classic case in a monopolist fishery).

When a goal other than efficiency is targeted, intervention in a fishery also increases the information requirements from the industry. South Africa, for example, requires detailed racial and gender employment breakdowns, given its stated desire to transform the fishery to better reflect its national demographics. Namibia requires increased local participation in its fisheries. Both these goals increase the information costs of monitoring the industry. These goals can also create an incentive for firms to misrepresent information to the authorities. Finally, because these goals are not directly concerned with economic efficiency, there is a limited extent to which the price mechanism can act as the relevant incentive in driving these outcomes.

Few fisheries contracts completely transfer the rights to the resource[16], as a quota can be further constrained by gear restrictions or processing details. For example, Namibia restricts freezer trawlers to only 40% of the TAC. Consequently it might be in the interests of the rights-holder to break aspects of the agreement. In other words, the interests of the two contracting parties (say the state and the quota holders) are not synchronised through their contract. Restrictions on catch, gear or effort, as well as closed seasons or effort, constitute such incomplete transfers of rights. They drive a wedge between the respective interests of the two contracting parties and consequently have implications for the structuring of any contract between them and for the information required to enforce the contract. Angola, Namibia and South Africa all have incomplete transfers of rights to the fishery. In South Africa for example the draft document on long-term rights explicitly states that property rights are not being transferred.

The incentive literature describes this principal-agent problem as *moral hazard*. It occurs whenever the contracting party that *bears* the risk and its consequences is not the party that *takes* the risk. In the fishing industry it occurs where the state manages the resource, but individuals or firms do the actual harvesting. Moral hazard follows when the fishermen try to exploit the resource more aggressively than the state desires. Such moral hazard increases the information, monitoring and enforcement costs needed if the resource is to be managed as the state intends.

Incomplete transfer of ownership is one source of difficulty; another may be that the objectives of the two parties simply do not concur. In the BCLME fisheries, for example, the state typically sets biological targets (such as maximum sustainable yield) while the industry has economic targets (such as maximum economic yield (MEY)). Here the incentives driving the fisher (maximising the present value of profit) may be out of alignment with the incentive driving management (maximising sustainable biological yield). This is indeed the case for

[16] Management and exclusion rights are usually not transferred. See Schlager and Ostrom (1992) for a fuller discussion.

South Africa where maximum sustainable yield (MSY) is the stated objective. What this means is that rights holders who maximise economic incentives will want to harvest at a rate that is different from that set by the government because the biological target of maximum sustainable yield does not make economic sense. Such an objective consequently imposes additional information (i.e. enforcement) costs on government.

Here the problem is that nation state level contracts (LOSC) conflict with the objectives of (a) economic efficiency – by focusing on managing MSY and not MEY (b) ecosystem management – MSY is meaningless if an area is being modelled for multi-species interactions rather than simple species yields.

Higher order rights (i.e. rights that allow the rights-holder to determine the appropriate technical restrictions) can be transferred. In the fishing industry this occurs when co-management brings the industry into the decision process. Ideally this aligns their incentives with those of government. Even in this case, however, some fishers may have an incentive to subvert the system and free ride on the restraint exercised by others. In a competitive industry, co-management need not mean reduced monitoring costs! Clearly this would not be an issue in the case of monopoly controlled fisheries provided future rights are assured and barriers to entry are in place.

This brings in a fundamental point – if sustainability is an aim of the State, then the optimal market structure is monopoly. If the fishery concerned is selling its product abroad, then the most suitable market structure is monopoly, and if there are organisational economies associated with vertical integration in product processing, then again monopoly or oligopoly power is appropriate. A feature of the fishing industry is that though it exploits a valuable resource that is in perpetual demand, fishermen remain poor and returns to investment in the sector are often low. Competition is not the solution to, but the cause of this problem!

There are aspects of the fishing industry that predispose it to contractual problems. Information is imperfect and asymmetrically distributed between the contracting parties. Neither the decision-maker (the state) nor its agent (the fishers) actually knows the extent of the true stock they are exploiting. Their ideas of it may also differ – fishermen form a picture on the basis of individual experience, the state uses collective experience. This is the gap in perceptions often seen in meetings between fishers and the authorities or marine scientists[17]. Often neither the size nor the age structure of the stock is known to the contracting parties when quotas are allocated.

A second issue is that behaviour, effort and catch are not easily monitored. This means that practices such as high-grading, fishing in marine reserves and use of prohibited gear are often both feasible and profitable. Operational Management Plans (OMPs) are an example of adaptation of the contract to address this problem. Using an iterative management process enables the state to penalise those who break the rules, without rendering the industry unprofitable.

The third basic question is, *how sensitive is the system to flawed data?* i.e. how robust is the user rights regime or set of contracts. The stocks of certain fish species experience natural cycles (e.g. the anchovy and pilchard stocks in the Southern BCLME). Moreover estimates of stock size and demographics are uncertain. It may also be difficult to distinguish between the stock effects of fishing strategy (quota etc) and natural fluctuations. This limits the ease with which self-correcting contracts can be designed.

[17] See, for example, Degnbol (2003), p. 31-49.

The introduction of the precautionary principal in the South African long-term rights document acknowledges the potential fallibility of data, and attempts to limit the adverse (and unanticipated) consequences on the resource of decisions based on uncertain data. Of course the cost of this caution comes in terms of profit and employment foregone. At its limit, the precautionary principle calls for the maintenance of an unexploited resource as this will minimise the risk of overexploitation. Of course this is extreme; the point is there is a trade-off and the precautionary principle is at odds with economic incentives, and will result in economic inefficiency. An additional consideration is whether or not the information set generated by the system has an implicit tendency to bias. Put differently, do firms and other players have an incentive to misrepresent their catch information? Certain forms of control depend on fishers giving accurate information to the authorities, although it might not be in an individual fisher's interest to do so. The South African draft document on long-term rights is a classic example where fishers are expected to accurately report their destructive effect on the ecosystem.

The robustness of the set of contracts also clearly depends on the nature of the resource harvested and the structure of the industry. In the case of long lived non-schooling species that aggregate to breed the consequences of over-fishing may not be obvious immediately. Short-lived schooling fish like small pelagics can easily experience short-run crashes; other species might not be robust to an excessive TAC in the short run. The difficulty is the limited scope for devising a contract to ameliorate the risks facing species prone to long lasting population crashes if over-fished. This difficulty in contracting stems partly from the intractability of placing the risk of collapse on the firms in the industry rather than the state. Under management regimes which penalise those who do not catch their quotas exactly, a stock crash may be exacerbated by the actions of fishers who seek to avoid penalties. Paper quota holders must be weeded out before the final allocation process in order to allow fishers to underfish if need be.

The insurance literature typically treats transfer of risk from individual firms to the state (or insurer) as socially desirable. This is usually because it is easier for one party to carry the risk than the other. In the case of an insurance company, it is able to spread the risk of an accident by having many policyholders, not all of whom are equally likely to have an accident at the same time. It is then socially desirable that the insurance company, and not the risk-averse policyholders, carry the risk.

The problem is how to align the interests of the insured individual with those of the risk-spreading insurer. The insured fisher is likely to take on more risks (i.e. overexploit the resource) now that he is insured against risk of collapse of the resource. Whenever the state intervenes to support fishermen after the collapse of a fishery, they are in effect offering an insurance service. The manner in which this is offered (vessel buybacks, unemployment benefits, changing size or closed area rules) can be controversial, may induce rent seeking and be potentially destructive to the resource. This is a vicious cycle; fishermen willingly overexploit the resource in the knowledge that the state will bail them out should the resource collapse. Newfoundland fisheries are a prime example of such behaviour.

The insurance literature stresses the difficulty of designing a complete (i.e. enforceable) contract in the presence of asymmetrical and imperfect information. This raises the costs of monitoring behaviour and encourages moral hazard. At some point it will be in societies' interest that the policyholders bear the full risk, because an incomplete contract that transfers risk away from the fisher is simply too expensive to enforce. One concern is that firms will under-invest in capital if they carry too much risk. This does not appear to be a problem in fisheries where over-investment is endemic.

Surprisingly, state regulation of a fishery is rarely justified on the grounds that the individuals participating in the fishery cannot bear the risk that the resource will collapse. Instead, in the theoretical literature at least, regulation is typically justified by the need to prevent overcapitalisation and overexploitation of the resource. This can be misleading: overcapitalisation and overexploitation may be the consequences of fishers not bearing the risk that they will collapse the resource. In this light, the starting point is to ask why the state needs to take on the insurance role in the fishery. Presumably, a private company could have provided this for all firms participating in the industry. One answer is that there might not be a demand for insurance. This would be the case if individual fishers were not risk-averse towards the collapse of the stock or if they consistently underestimated the risk of collapse. Part of the answer to developing conservation-compatible behaviour then is to eliminate interventions that result in fishers not being risk-averse towards their resource.

Fisheries are complex systems, and assuming the role of insurer typically places formidable information demands on the insurer. It can be extremely difficult to quantify the risk of collapse, and a private insurance market might not clear at a price acceptable to the fishers. The very act of acquiring the information necessary for modelling the resource can often lead to increased pressure on the resource (since fishers know the resource is out there), or drain the state of resources that could otherwise be employed elsewhere. Even in countries where the state has access to large resources it will often respond to fishers who come under pressure from resource collapse by not reducing TACs sufficiently quickly, by offering alternative species to harvest, or by subsidising alternative lifestyles. These political outcomes all exacerbate the moral hazard problem, and thus raise the cost of insurance.

This typically places the onus on the state to design and enforce a management system for the utilisation of the resource that will result in the fishers exploiting the resource in a manner compatible with the aims of the state. Like any contract where risk payoffs are not aligned, this design suffers from perverse incentives. Any design system that mitigates the negative consequences of resource collapse for the fisher suffers a potential moral hazard problem.

In certain cases, lack of intervention could perpetuate a lack of risk-aversion on the part of fishers. The most widely cited is the ‘tragedy of the commons’ where open access inhibits an individual from preventing others from exploiting the resource. In such a scenario, it is in each fisher’s interest to be risk-loving and to overexploit the resource. Fishers that are risk-neutral will be systematically at a disadvantage to their risk-loving brethren. However, in fisheries where entry is limited (various barriers to entry) it is not immediately clear why fishers should not be risk-averse. Lack of such behaviour on their part can often be explained because the state has taken on the risk of collapse that the fishers would otherwise bear. In such a scenario the intervention is not helpful.

Where fishers view their rights allocation from a long term perspective, we may see the incentives of the state and fishers more aligned, at least at the beginning of contracts. Depending on how rights are allocated, fishers may have an incentive to over fish at the end of their contract periods, in order to demonstrate capacity. Adequate monitoring is the only response to such action, which gives fishers the assurance that their single actions to not over-fish will not disadvantage them in a rights allocation process. Rights must be allocated to permit holders in such a way as to reward fishers who hold a conservative outlook on the resource, and to weed out paper quota holders before any allocation takes place. The greater the security of rights holders’ tenure, and the higher the level of monitoring, the more likely permit holders will hold a conservative outlook to the resource.

Fishers and fisheries management are engaged in an interaction where repetition, reputation, and locality make a big difference in determining the actions of the various

players. Each of these factors has a large effect on how much information is available in each interaction. Fishers and management are engaged in a repeated game, with an infinite number of periods. Every time that rights are re-allocated, the game is repeated. When longer term rights are allocated, rights holders tend to view the game with a longer term perspective. If rights holders know that their current behaviour may affect future allocations, as the game is always repeated, this may curb any excesses in their behaviour.

The reputation of the various players is also important in determining what outcomes will occur following the rights allocation. If management has a reputation for strict monitoring, and fair allocation, rights holders will be more likely to respect their quotas, and keep to sustainable fishing practices. If management has a reputation for a supposedly strong attitude, but in practice there is no evidence to support this, rights holders will do as much as they can possibly get away with.

The location of the interaction and the relationship between the rights holders and management will also have an effect on the nature of the interaction. We might expect to see small artisanal fishers in South Africa or Angola indulging in over- fishing if the monitoring and management is executed by distant government officials with no perceived connection to the local community. If however monitoring and management are done by local community leaders, they are more likely to succeed, as these leaders will have far more information, based on their previous interactions in the community. Rights holders are also more likely to respect the reputations of known community leaders, and to feel a duty to act for the perceived long term good of the community.

Reputation effects can be an issue in international commercial fisheries. The negative response of many fisheries managers to Spanish companies is a case in point. Setting up a local example, if South African companies are allocated rights in Angola, and they feel that monitoring is likely to be poor, and rights temporary, they will have a strong incentive to over-fish. If there is no perceived benefit to 'good reputation' and fishers feel no 'ownership' of the resource, the incentive is to exploit it as much as possible while they have the opportunity. Joint participation in the co-management of the BCLME fisheries, and long term rights allocations across all three countries, would serve to decrease this effect.

The situation is further complicated when fishing stocks straddle national boundaries. This is the case for a number of BCLMÉ fisheries. Since each state (Angola, Namibia, and South Africa) has not taken on the full risk of resource collapse it no longer has the incentive to design a contract with individual fishers to act as if they bore the full risk of collapse. Efforts to conserve straddling stock are not necessary credible to the participants if governments act in isolation since none is directly responsible for the collapse of the resource.

If stocks are truly straddling, this suggests a need for states to contract between themselves to align their incentives such that each bears the full risk of resource collapse. However, this might not be possible, leaving each state with similar contractual difficulties as those between states and agents. A major difficulty in reaching agreement can be if countries have very different management goals and place different value on the fishery (i.e. have different discount rates). The picture is further complicated by agents' awareness of these difficulties. For example the difficulty of monitoring any sort of contract for individual states would increase, as each state is unable to monitor the other nation's fleets. This would exacerbate the problem of moral hazard.

The effort or costs of setting up a joint management system, or an environmental agreement, between the countries involved may not be able to improve on the non-cooperative outcome if there are many countries involved in the management of the stock, or if countries find it

difficult to come to an agreement (Barrett, 1994). Barrett (1994) shows that depending on the specification, a self enforcing international environmental agreement may not exist, or may not be able to sustain more than a few signatory countries, which is not useful if the number of countries sharing the resource is large. For the BCLME countries, the fact that only 3 parties are involved is a definite benefit for the conservation and management of their shared resources.

This also applies to efforts to transform the fishery where a transformation agenda can give companies an incentive to misrepresent their credentials. Companies might set up front companies in order to mislead regulators, who in turn need to invest heavily in verification infrastructure. Clearly, there is a cost to efficiency here. Lack of clarity can impose costs on firms too – see for example Oceana's problems with quota. It is not economically efficient if both companies and government are investing resources into contract deviation, and into detecting contract deviation.

Co-management has enjoyed limited success in the BCLME. In South Africa, particularly with respect to artisanal fishers, the policy has not been seen as a success[18]. The recent broadening of access in the commercial fisheries has complicated the task of co-managing the resource as it has introduced additional role-players. Namibia has no artisanal fishery, and there has been little attempt to introduce co-management principles in the commercial sector. Angola is the most notional of the three where co-management principles are largely rhetoric.

[18] See Sowman, M. 2003

5. A SUMMARY OF RIGHTS ALLOCATIONS ISSUES

Some of the important questions to be considered in fisheries management include:

1. Who has the property right to the resource, and how is it allocated?
2. How is the right to the resource priced?
3. Are rights allocated to vessel owners, or to individuals who then trade with vessel owners after allocation?
4. Are the rights to the resource truly rights, in that they are tradable, secure, exclusive, and durable?
5. Are rights allocated for short or long term periods?
6. How does harvesting of one particular species affect other species in the food chain?
7. Who bears the costs of monitoring and scientific research about stock levels?
8. How are migratory and trans-boundary stocks managed?
9. What effort controls are in place, and how do they affect incentives and efficiency?
10. Can foreign firms buy in and thereby access rights? If so, what percentage of rights is foreign owned or leased? And what system is in place to regulate this process?
11. Is an operational management procedure (OMP) in place to manage stocks? If not, what management regime is in place?
12. How do information asymmetries affect the various parties in the contracts?

If effort controls or gear restrictions are in place, some relevant questions include:

1. Are there restrictions on gear/equipment used? What is the intended purpose of these restrictions?
2. Are there geographic restrictions on fishing?
3. Are closed seasons in place?
4. Is effort restricted, in terms of the number of crew, or vessels, or capacity or size of vessel?
5. Are restrictions in place on types of technology used: e.g. restrictions of a hake rights holder's ability to use freezer trawlers rather than wetfish vessels, or restrictions on the proportion of catch that can be caught using long lines?
6. What measures are in place to restrict excess by-catch? Is a value placed on by-catch, or penalties? Does the main quota include a quota for the by-catch species?
7. What penalties are in place? What incentives do they create?

It has been shown that the allocation of fishing rights constitutes a contract between the rights holder and the state. The terms of the contract have the capacity to induce changes in behaviour; in particular they can induce perverse outcomes by providing incentives to over-fishing, over-capitalisation and rent dissipation. The following sections provide the basic details of the contracts currently or recently in place.

5.1 South Africa: Rights Allocation Summary

5.1.1 Introduction

The key feature of the current (2005/6) rights allocation system is that the quotas issued entail long term rights, typically for 10 to 15 years. During 2001 a medium term rights allocation process was initiated, in which 4-year long commercial fishing rights worth approximately R15 billion[19] were issued. A lump-sum application fee of R6000 was charged for these medium term rights, irrespective of size of applicant or quantum allocated. Although intended to act as a disincentive to opportunistic applicants, this charge had only moderate success and proved controversially regressive. Prior to 2001, rights had been allocated annually to approximately 400 right holders. The medium term fishing rights, however, were allocated to more than 3900 right holders (individuals and commercial entities), with an emphasis on small and medium sized entities and black empowerment.

The allocation of commercial fishing rights in 2005/6 is for periods ranging between 8 years and 15 years, with the rights allocated across 20 fisheries, ranging from capital intensive and financially lucrative fisheries such Hake Deep Sea Trawl and Patagonian Toothfish to traditional and less lucrative. The authority to allocate fishing rights is vested in the Minister of Environmental Affairs and Tourism.

The long term rights allocation process was described as premised on four considerations:

- Broad based black economic empowerment.
- Biological considerations: a biologically determined and sustainable management framework.
- Ecological considerations: commitment to measure the impacts of fishing on marine ecosystems and to mitigate these impacts.
- Socio-economic considerations: management that is conducive to growth and investment, together with job creation, poverty elimination and empowerment along the coast.

The estimated value of the commercial fishing rights to be allocated this year is R70 billion. The South African fishing industry is worth approximately R4 billion annually, with hake deep sea trawl accounting for slightly less than 50% at present hake market values. The industry as a whole employs some 29 000 persons directly both on land and at sea. Salaries for persons below management level (factory worker to skipper) in the more capital intensive fisheries (such as hake trawl, pelagics, south coast rock lobster and horse mackerel) range from approximately R63 000 annually to slightly more than R90 000 annually. In the smaller fisheries, seasonal work is prevalent with increasingly less employment security. The policies aim at affirming those persons who have provided crew with full-time or permanent work, medical aid and pension security. In addition, the policies also aim at measuring how many jobs are created per ton of fish allocated between 2002 and 2005 and how many jobs were shed over the period.

The allocation of long term rights to small black entrepreneurs was intended to enhance their access to loan capital at competitive rates as each right allocated provides security. At the same time the larger enterprises were intended to benefit from a legally sound allocations

[19] Between 2001 and 2006 the exchange rate against the US Dollar fluctuated between lows of roughly 12 Rands to the Dollar and highs of approximately 6.5 Rands to the Dollar. The Namibian Dollar and the Rand have been on a 1:1 peg throughout this entire period.

process, secure long term rights that would encourage recapitalisation, and compliance with international obligations.

Evaluation of applications followed a set of evaluation criteria:

- Firstly, every application had to satisfy a set of exclusionary criteria.
- Secondly, applicants that satisfied these criteria were compared through a set of competitive criteria to identify most transformed and best performing applicants prior to rights allocation.
- Thirdly, successful applicants are allocated a proportion of the total allowable catch or total applied effort.

5.1.2 Permit Structure in South Africa

Relevant conditions to the permits allocated include:

- Reference to the Permit Holder includes all crew, employees, contractors, agents, advisers, and the skipper of the vessel.
- Conditions are binding on the permit holder and all employees, crew, agents, advisers, and the skipper
- If conditions are not adhered to, the Department may refuse to re-issue the permit, and may institute proceedings against the permit holder.
- No transhipment without written permission from the Department of Fisheries (lack of compliance allows the Department to revoke the permit)
- Harvesting may not be over or under the amount of fish allocated. Penalties will be laid down, according to Act 28.

Submission of Information: The permit holder is required to submit to the Department details of the transformation profile of the right holder, turnover, fish harvested and sold monthly, and average monthly prices obtained. This information is required to be submitted *yearly*. Failure to submit information to the Department may result in withdrawal of the permit.

Catch Statistics: Catch and effort statistics, such as amount of fish harvested and landed, effort deployed, vessel details, if any fish were harvested for a third party, and details, the number of trips where other gear was used (for example hake trawling), and what by-catch measures have been implemented, must be submitted to the Department of Fisheries, on a *monthly* basis. Failure to submit this information may result in a delay in the permit re-issue until the information has been submitted.

Fishing Area: No fishing may take place within 5nm of the coast in the area west of 20 degrees E longitude. In the area between 20E longitude, and 27E, no fishing may take place in water less than 110m deep or within 20nm of the coast, whichever is the greater distance from the coast. No fishing is allowed within False Bay north of a line drawn between the lighthouses of Cape Point and Cape Hangklip. Other geographical areas may be off limits, at certain times, due to spawning.

Vessel Monitoring Systems: An approved VMS must be fitted, which reports continuously to the VMS Base station at the Department of Fisheries.

Vessel Specifications: Vessels must be clearly marked to indicate their target species. Only registered vessels which have been clearly marked may be used by the permit holder.

Catch Limitations and Controls: Regulations apply to the fishing gear used. Certain restrictions are placed on mid water trawl and deepwater trawl equipment[20]. Use of certain types of equipment, such as cod liners and others is prohibited. Permit holders may only keep the relevant equipment on board for their particular permit, unless they hold two permits simultaneously, in which case both types of gear may be present on board. Permit holders are required to nominate to the Department of Fisheries which vessels will activate which rights in isolation, or simultaneously with other rights held by the permit holder. Any changes in a vessel's status must also be notified to the Department. All species caught by those who do not hold rights for that particular species must record this catch and deduct it from the by-catch reserve allocated for the season for that species. Transhipment is allowed within a South African port, with the relevant permit only. Transhipment may be subject to inspection. All species caught must be recorded and deducted from the permit holder's allocation for the season. Transhipment is banned for most species, without the relevant permit, and permit holders may be forced to land and process certain species on shore.

By-catch: Permit holders are required to take measures to mitigate by-catch. If the permit holder's by-catch of kingklip and monkfish exceeds the average catch over the period 1998 to 2002, the Department of Fisheries may prevent the permit holder from fishing for the rest of the allocation year. A precautionary maximum catch limit may be set for certain by-catch species. Fishing is not allowed in certain by-catch species' spawning areas. These areas are specified in the permit. The permit holder must submit to the department what measures he has taken to mitigate the harvesting of fish which are not the target species.

Landing of Fish: All details of landings must be reported to the local Fishery control officer within 24 hours prior to landing, including vessel details, right holder name, estimated catch, species caught, estimated time of arrival, and port of arrival. This information must also be copied to the relevant Fisheries Department authority. Fish may not be discharged from the vessel without the above conditions having been fulfilled. Vessels authorised to tranship fish within a South African port may do so, in adherence to their transhipment permit. The entire catch must be discharged at one landing point only. Failure to adhere to the above conditions will result in confiscation of all fish landed, and further proceedings against the permit holder.

Levies: Levies are payable for fish landed, and in general must be paid in full and *in advance*. Levies are calculated on the tonnage allocated by the Department for that fishing season. Permits may only be issued once all levies have been paid.

Observer Programme: The permit holder is required to carry on board one or more observers at times during the fishing season, and to accommodate them at the level accorded to an officer, and to pay proportionately for the costs of the observer programme. Those vessels targeting horse mackerel only will be required to carry an observer on every trip. Permit holders are not permitted to obstruct the duties of the observer.

Compliance: Permit holders are required to report to the department in writing any perceived breach of permit conditions.

We now take a more in-depth look at each fishery, and investigate how its permits differ from the general permit described above. For clarity, we note only those differences from the general permit described above.

[20] Mid water trawl with a minimum mesh size (measured knot to knot and stretched to maximum tension of 5 kilos) of 85mm (in the area west of 20E longitude), and 75mm (east of 20E longitude). Bottom trawl with a minimum mesh size of 110mm. No bobbins or other devices designed to enable the foot rope of the trawl net to roll over the sea bed with a diameter in excess of 750mm, may be used.

5.1.3 Hake Fisheries

South African hake stocks are targeted by four separate commercial fisheries, a hake deep sea trawl fishery, a hake inshore trawl fishery, a hake long line fishery and a hake hand line fishery.

South Africa manages each of the four hake fisheries as part of a "hake collective". An OMP is used to set an annual TAC for all hakes in South African waters. Of the global hake TAC a reserve to cover by-catch in the horse mackerel fishery is set aside prior to distribution among the hake fishing sectors. Currently the global hake TAC (after deduction of the horse mackerel by-catch reserve) is distributed among the deep-sea trawl, inshore trawl, hake lone line and hake hand line fishery sectors without regard to the hake species split in the respective fishery sectors. In terms of that arrangement, 83% is allocated to deep-sea trawl, 7% to inshore trawl and 10% is shared between hake long line and hake hand line. However, a sectoral allocation procedure that takes cognisance of the species taken by that sector and the contribution of that species to the global TAC may have to be developed in order to match hake exploitation to the productivity of the two hake species.

The hake fisheries are currently managed conservatively as current biological information indicates that South African hake stocks may be overexploited. In 2005 South Africa's fisheries department, Marine and Coastal Management failed to carry out a hake trawl survey for the first time since TAC's were set. This failure broke the survey time series and may require significant reductions in the TAC over the coming years in compliance with NEMA's section 2 principle on precautionary management.

5.1.3.1 Hake Fisheries: Deep Sea Trawl

Sector Facts:

- TAC: 124 500 tons
- Jobs Sustained: 8900 jobs
- Investments in Fixed Assets (Insured Values): R2,4 billion
- Number of Vessels: 79
- Number of Right Holders: 46
- Duration of Rights: 01 January 2006 to 31 December 2020

Contract related challenges include:

- Managing the ecological impacts of bottom trawling.
- Increasing the competitiveness of South African hake on international markets.
- Maintaining MSC certification (ecolabelling).
- Reducing effort levels in the fishery, particularly effort creep over the long term.

The allocation of long-term rights will provide the deep-sea trawl fishery with two particular economic opportunities:

- To consolidate the number of right holders;
- To use the Marine Stewardship Council’s certification to market SA hake more effectively.

In both Namibia and South Africa, the control of by-catch, especially high valued by-catch is a problem. Note, however, that ships have been held for targeting low valued by-catch species such as snoek! In South Africa the following measures are in place:

- Permit holders are required to take measures to mitigate by-catch, in particular kingklip and monkfish.
- If the permit holder's by-catch of kingklip and monkfish exceeds the average catch over the period 1998 to 2002, the Department of Fisheries may prevent the permit holder from fishing for the rest of the allocation year.
- A precautionary maximum catch limit of 3000 tons is set for kingklip by-catch for trawl and line hake directed fisheries. This includes both deep sea hake trawling, inshore and long line hake, and mid water Horse Mackerel Trawling.
- No fishing is allowed in kingklip spawning areas, which are noted in the permit, for the period 1 September to 30 November by either Deep Sea trawlers, inshore hake trawlers, long line hake fishers, or mid water Horse Mackerel Trawlers.
- A precautionary maximum catch limit of 7000 tons is set for monkfish by-catch for trawl and line hake directed fisheries. This includes both deep sea trawling, inshore hake trawling, and mid water Horse Mackerel Trawlers.
- Those vessels targeting horse mackerel only will be required to carry an observer on every trip.

5.1.3.2 Hake Fisheries: Inshore Trawl

Inshore trawlers primarily target "Cape" hake (*Merluccius capensis*) and (on the South Coast) the more valuable Agulhas sole (*Austroglossus pectoralis*). The inshore trawl fishery continues as a "dual quota" fishery targeting both shallow-water hake and Agulhas sole. Despite the fact that inshore trawling is done in areas away from the BCLME areas, this fishery targets hake which is part of the BCLME shared fisheries.

As was the case with the deep-sea trawl fishery, prior to 1978 the inshore trawl fishery was largely unregulated and participants were not restricted to a maximum catch limit. In 1978, the demersal fishery was formally separated into inshore and offshore sectors, a global annual total allowable catch ("TAC") was introduced and was divided between the sectors. An annual sole TAC was also set. Individual quotas were introduced in 1982. Since then, an annual TAC has been set for both the Cape hakes and for Agulhas sole. The inshore trawl fishery has been managed in terms of a sole TAC and a portion of the hake TAC. The sectoral allocation of the global hake TAC has remained remarkably stable at around 6 percent.

Currently the global hake TAC (after deduction of the horse mackerel by-catch reserve) is distributed among the deep-sea trawl, inshore trawl, hake lone line and hake hand line fishery sectors without regard to the hake species split in the respective fishery sectors. In terms of that arrangement, 83% is allocated to deep-sea trawl, 7% to inshore trawl and 10% is shared between hake long line and hake hand line. However, a sectoral allocation procedure that takes cognisance of the species taken by that sector and the contribution of that species to the global TAC may have to be developed in order to match hake exploitation to the productivity of the two hake species. In terms of such a procedure, the sectoral allocation of hake to the Inshore Trawl Fishery would be determined only by the status of the shallow-water hake resource.

The inshore trawl fishery is not as capital intensive as the deep-sea trawl fishery, but significant investments in the form of vessels, processing and marketing infrastructure have nevertheless been made by the existing participants.

Sector Facts:

- TAC: 9000 tons
- Jobs Sustained: 1480
- Gross Asset Value: R1,473 billion
- Mean Annual Turnover: R73,86 million
- Number of Vessels: 31
- Number of Right Holders: 17
- Duration of Rights: 01 January 2006 to 31 December 2015

Extra or specific permit conditions include:

- The use of 75mm mesh nets will be permitted only by vessels targeting sole on the designated sole grounds, at all other times a minimum mesh size of 110mm shall apply to bottom trawl gear.
- No bobbins or any device designed to enable the foot rope of the trawl net to roll over the sea bed with a diameter in excess of 375mm shall be used.
- The permit holder will take steps to reduce its by-catch of kingklip and monkfish to a level not exceeding its average catch over the period 1998 to 2002, and its cob catch to a level not exceeding 80% of its average catch over the period 1998 to 2002.
- If the permit holder's by-catch of kingklip, monkfish or cob exceeds these levels the Department of Fisheries may prevent the permit holder from fishing for the rest of the allocation year.
- If the catch of cob taken on any one drag is more than 20% of the sole catch or 2% of the hake catch (by weight) then the vessel must move to an area at least 5 nautical miles from that fishing position.

5.1.3.3 Hake Fisheries: Long line

Longlining started in 1982. Between 1985 and 1990 much of the long line activity was re-directed from hake to kingklip as the latter was significantly more valuable. The kingklip stock was severely depleted by the experimental fishery, and the experiment was terminated in 1990. Hake longlining was reintroduced as an experimental fishery in 1994. Commercial fishing rights were issued in 1999 and 2000, but were set aside by the courts. Stability was achieved in 2001 with the allocation of four-year commercial hake long line fishing rights.

The hake long line fishery is less capital intensive than trawling. The long line industry lands prime quality hake for export to Europe. Historically its value was approximately 50 percent higher than that of equivalent trawled hake. Over time the CPUE in the sector has declined, longlined fish have become smaller and competition with trawlers more direct and intense. There remains a debate as to whether longlining harms the resource excessively or benefits it. Demersal trawls (dragging) adversely affect the seabed ecosystem; by comparison

longlines do little damage. On the other hand they target fish in areas with rocky sea beds that might otherwise act as de facto reserves.

The fishery operates in offshore and inshore waters. Inshore hake longlining is restricted to the use of no more than 4 000 hooks per line. Offshore longlining may only take place in depths greater than 110 metres and is restricted to the use of no more than 20 000 hooks per line. Vessels and operating costs differ between inshore and offshore operations.

Sector Facts:

- TAC: 11000 tons
- Jobs Sustained: 1495
- Gross Asset Value: R182 million
- Number of Vessels: 64
- Number of Right Holders: 132
- Duration of Rights: 01 January 2006 to 31 December 2020

Sector Challenges:

As elsewhere in the industry, the allocation of many unviable quotas challenges the economic viability of the fishery. Any reductions in the TAC could force many rights holders to become paper quota holders or to consolidate with other rights holders.

Extra ordinary or specific permit conditions include:

- There shall be no transhipment of fish. Contravention will result in the revoking of the commercial right.
- Monthly catch statistics are also required by the Department, including details of sea birds killed, catch and effort details, and by-catch mitigation and prevention measures implemented.
- The permit holder must submit details of whether any fish harvested was for the account of a third party, and the details of the harvest and the third party.
- Details of the fish processing plant to which the catch is destined are also required, thus helping to keep a paper trail of all landings. This data is required to be submitted by hand or posted within 30 days of landing to the Department.
- Fishing is permitted only within South African waters, excluding however tidal lagoons, rivers, and estuaries, and may not take place within 5 nautical miles of the coast line.
- Fishing and landing is also not permitted east of 20 degrees East Longitude.
- Permit holders are not permitted to activate any other fishing rights they may simultaneously hold while fishing for long line hake, and may only utilise bottom set long lines, with a maximum of 20 000 hooks deployed daily (West Coast long line and South Coast off shore long line). South Coast long line hake permit holders shall only utilise bottom set long lines with a maximum of 5000 hooks deployed daily.
- No other gear is allowed on board.
- Precautions must be taken to avoid unnecessary sea bird deaths. Such precautions include only shooting long lines during hours of darkness, with gear deployment

stopping at least one hour before dawn, and using streamer lines above each main line.

- Dumping of fishing gear is not permitted, and attempts must be made to recover lost gear.
- Deck lighting must be kept to a minimum, and must be directed down towards the deck.
- The permit holder must attempt to prevent the harvesting of by-catch for which he does not have a permit. The permit holder must only target hake, and must move the vessel to more than 5 nautical miles of a position where kingklip has made up more than 10% of the catch.
- Kingklip by-catch shall not exceed 8% of the nominal hake mass on any one landing.
- The permit holder is also required to report to the Department the measures taken to avoid by-catch and sea bird deaths, and to implement the bird mitigation measures described in the permit.
- Banded birds caught must be retained frozen and handed over to the necessary authorities.
- The permit holder shall ensure that its vessel has on board an approved streamer line or tori line which must be flown during the setting of each long line, and must be deployed directly above the main line, or on either side if 2 streamers are used.
- Fish may only be discharged at approved landing points, and in particular, at the permit holder's registered home port only. Limited hours are set for catch discharge times.
- Daily landing logs must be kept by Hake Long line South Coast Inshore and Offshore Permit Holders, which must also state to which factory or processor the catch is to be delivered.
- Certain areas are set aside as restricted areas where trawl nets are not to be used.

5.1.4 Horse Mackerel Mid-Water Trawl

The southern African subspecies of horse mackerel (Trachurus trachurus capensis) is found along the entire South African coast. Although historically abundant on the West coast, the largest concentrations of adult fish are currently found off the South Coast. Juveniles occur inshore, mainly on the west coast, where they are caught by the purse-seine fishery during the first quarter of the year.

The South African horse mackerel stock is comparatively small in comparison with the stocks in Namibia and Angola. The status of the South African stock is still being assessed. For this reason, the horse mackerel fishery is managed in terms of a precautionary maximum catch limit ("PMCL"). The PMCL has fluctuated between 22 000 and 54 000 tons since 1990.

It is important to note that the Cape horse mackerel is highly nomadic. Local availability is variable and dependent on environmental conditions. The horse mackerel resource is harvested mainly by targeted mid-water trawling but there are substantial targeted and incidental catches in the hake-directed bottom trawl fishery. In addition, juvenile horse mackerel is taken as a by-catch in the purse-seine fishery on the west coast. While generally low, the catch of juveniles by the purse-seine fishery has on occasion been substantial and is currently subject to a strict limit of 5 000 tons per annum.

Management of the horse mackerel resource in South African waters is hampered by a lack of data, particularly the lack of suitable time-series of abundance indices. The most reliable current abundance index is derived from the demersal trawl surveys using bottom trawl gear. However, as this resource is semi-pelagic, this index most likely underestimates the size of the resource. Consequently, the status and productivity of the resource is less well known relative to other South African resources such as hake, sardine and anchovy. The data on horse mackerel are inadequate because the primary research focus of monitoring surveys has been the assessment of established fisheries such as hake and sardine.

The majority of horse mackerel is caught by a single mid-water directed trawler. The majority of horse mackerel is transhipped and exported without landing or processing in South Africa. The fish is exported to West Africa, earning approximately R2.50 per kilogram.

Sector Facts:

- PMCL: 31500 tons
- Jobs Sustained: 527 jobs
- Gross Asset Value: R2,455 billion
- Mean Annual Turnover of Right Holders: R155 million
- Mean Profit after Tax: R33,4 million
- Number of Vessels: 6 vessels (3 right holders are to nominate alternative vessels)
- Number of Right Holders: 15
- Duration of Rights: 01 January 2006 to 31 December 2015

Although there are relatively few participants in the industry, one of the problems faced is the number of participants with weak performance histories. These will probably need to consolidate over time if overcapitalisation and rent dissipation are to be avoided.

Extra ordinary or specific permit conditions include:

- The permit is issued subject to the further provisions of the Horse Mackerel Fishery Policy and Fishery Manual.
- If the Permit Holder is a hake deep sea trawl right holder, they are required to submit to the Department with other catch statistics, the number of trips where both mid water and deep sea trawl gear were utilised, and what quanta in kilograms of hake and horse mackerel were harvested.
- No fishing may take place within 5nm of the coast in the area west of 20 degrees east longitude
- Permit holders that do not in addition hold a permit for deep water hake trawling may only use mid water trawl equipment.
- Permit holders are required to nominate to the Department of Fisheries which vessels will activate the mid water horse mackerel right only, the deep water hake right only or both rights at the same time. Any changes in a vessel's status must also be notified to the Department.
- Vessels which only hold the horse mackerel right may not hold any other gear on board besides mid water trawl equipment, and may only target horse mackerel.

- A maximum limit of hake by-catch is allowed, which is 4% of the nominal mass of horse mackerel at any landing, to those permit holders who do not hold hake deep water rights.
- The total hake by-catch within a given year may not exceed 2% of the horse mackerel catch.
- Transhipment is allowed within a South African port, and with the relevant permit, to those permit holders who do not have a deep water hake right. Transhipment may be subject to inspection.
- Simultaneous permit holders of deep water hake and horse mackerel mid water trawl may use both sets of gear on board the vessel, but no other types of gear may be present on board. All horse mackerel and hake caught must be recorded and deducted from the permit holder's allocation for the season. No transhipment of horse mackerel is allowed for these permit holders, and horse mackerel must be landed and processed on shore.
- Permit holders are required to take measures to mitigate by-catch, in particular kingklip and monkfish.
- If the permit holder's by-catch of kingklip and monkfish exceeds the average catch over the period 1998 to 2002, the Department of Fisheries may prevent the permit holder from fishing for the rest of the allocation year.
- Those vessels targeting horse mackerel only will be required to carry an observer on every trip.
- Permit holders are not permitted to obstruct the duties of the observer.

5.1.5 Small Pelagics

The small pelagic fishery dates back to the late 1940s when a fleet of privately owned purse-seine vessels began targeting sardine and horse mackerel. In 1953 an annual maximum catch limit of 270 000 tons was set but was never enforced. As a result, catches regularly exceeded this figure. By 1961, the maximum limit was repealed. In 1962, more than 410 000 tons of sardine were landed, but by 1966, the catch had dropped to 100 000 tons. The fleet then started targeting anchovy, using nets with a smaller mesh size. In 1987 anchovy catches peaked at 600 000 tons, but catches declined thereafter and in 1996 only 40 000 tons of anchovy were landed. Anchovy and sardine catches have subsequently increased, with landings of both species averaging around 250 000t each over the past five years. The fishery is currently managed in terms of an Operational Management Procedure ("OMP") that sets annual Total Allowable Catches ("TAC") for anchovy and sardine.

In terms of catch volumes, the small pelagic fishery remains the largest in South Africa. It is the second most important in terms of value. This fishery's management procedure is the most complex of the commercial fisheries. Two species are the main targets, namely sardine (Sardinops sagax) and anchovy (*Engraulus encrasicolus*), with associated by-catch species being red-eye round herring (*Etrumeus whiteheadii*) and Cape horse-mackerel (*Trachurus trachurus capensis*). Sardine is canned for human consumption while anchovy and most of the by-catch species are reduced to fishmeal, fish oil and fish paste.

Small pelagic targeting occurs inshore, primarily along the Western Cape's west and south coasts (anchovy and sardine) and the Eastern Cape coast (sardine). The fishery is capital intensive, with right-holders having to invest in vessels and processing and marketing infrastructure, or gain access to such through catching and processing agreements. The

allocation of long-term rights should allow some consolidation, especially among smaller right holders.

Sector Facts:

- TAC: 202 000 tons (sardine) & 212 251 tons (anchovy)
- Jobs Sustained: 15 133
- Gross Asset Value: R1,218 billion
- Mean Annual Turnover: R2,9 million
- Number of Vessels: 101 vessels
- Number of Right Holders: 95
- Duration of Rights: 15 January 2006 to 31 December 2020

There have been recent investigations into over-fishing and under-reporting.

Extra ordinary or specific permit conditions for Small Pelagics (Pilchard and Anchovy) include:

- The Permit Holder may only harvest the amount of fish allocated to it in terms of the total allowable catch TAC and/or total applied effort TAE allocated to it. Fishing over or under these limits will result in the initiation of proceedings.
- On completion of the offloading process, the mass of the applicable landing must be completed on the relevant landing report, and certified as correct by both the Right Holder (or nominated representative), and the Fishery Control Officer (or Marine Resources Monitor).
- The TAC species caught shall be deducted from the Right allocated to the Right holder. All fish must be weighed in the presence of the skipper and a Fishery Control Officer.
- Weekly summaries of catches must be submitted.
- The Permit holder shall conduct operations strictly in accordance with the attached by-catch allowance schedule.
- The permit holder may not activate any other fishing right allocated to it whilst operation in terms of the provision of the permit.
- The permit holder shall only utilise purse seine net, and no other gear is allowed on board the vessel.
- No fish other than pilchard, mackerel, red eye or lanternfish may be targeted by pilchard quota holders, and no fish other than anchovy, mackerel, red eye or lanternfish may be targeted by anchovy quota holders.
- No pelagic fish may be dumped or discarded into the sea or deliberately freed from the net.
- All line fish species landed shall be forfeited to the State and must be handed to the Fishery Control Officer.
- An anchovy permit holder who reaches his apportioned pilchard by-catch allowance *shall cease fishing immediately*.

- The permit holder shall inform the local Fishery Control Officer at least 2 hours prior to the intended time of landing of the relevant landing details.
- Fish may only be discharged at approved landing points. The entire catch (including any by-catch) must be discharged at one landing point only.
- If circumstances render it impossible to land fish to the prescribed factory, immediate notification where possible must be given to the local Fishery Control Officer. Written notification must be given within 48 hours of landing and particulars of the catch and the reason why the prescribed factory was not utilised must be included.
- Before the commencement of offloading, the duly completed Daily Pelagic Catch Statistics form must be handed to the Fishery Control Officer. The completed form must contain an accurate (within 10%) species composition, by mass per haul, of the applicable landing reflecting all species caught.

5.1.6 West Coast Rock Lobster

West coast rock lobsters (*Jasus lalandii*) are slow-growing, long-lived animals. Female size at maturity varies from 57 millimetres carapace length (CL) to 66 millimetres CL. Male lobsters attain a larger size and grow faster than females. As a result of the size limit of 75 mm CL that is imposed on commercial fishers, male lobsters make up 90 to 99 percent of the catch. Rock lobsters occur inside the 200m depth contour from just north of Walvis Bay in Namibia to East London. Commercial exploitation occurs from about 25 S in Namibia to Gansbaai on the Cape south coast.

The current harvestable biomass is estimated at approximately eight percent of the pre-exploitation levels, and the spawning biomass at approximately 21 percent. These low levels are attributed to two factors: large unsustainable historic catches, particularly during the first half of the 20th century, and a substantial reduction in the somatic growth rate during the 1990's.

Commercial fishing began in the 1880's. The commercial fishery expanded rapidly in the early part of the 20th century. Although catch records prior to 1940 are sparse, catches appear to have peaked in the period 1950 to 1965, when between 13 000 and 16 000 tons were landed annually.

Prior to 1946, the commercial fishery was unregulated. In that year, a ‘tail-mass’ production quota was imposed to control exports. This formed the basis of the "output-controlled" management philosophy that is still used to manage the west coast rock lobster resource today.

From 1946 onwards, annual quotas were granted, based primarily on the condition of the fishery in the preceding season. Until the mid-1960's, catches were directly controlled by these quotas. In the 1967/68 fishing season, catch rates began to decline and quotas remained unfilled. Decreases in the Total Allowable Catch ("TAC") to between 4 000 and 6 000 tons restored some balance in the period 1970/71 to 1989/90.

The tail-mass production quota was replaced by a whole lobster (landed mass) quota, and management by means of a TAC was introduced in the early 1980's. Area or zonal allocations were introduced at the same time. Other management measures that were enforced early on were size limits and a closed season – no fishing takes place between August and October. Catches of berried or soft-shelled lobsters were banned. The 1990/91 season again saw the catch rates drop and, in the ensuing years, the commercial TAC was

gradually reduced, reaching 1 500 tons in the 1995/96 season. Since then, there has been a slow recovery, with the commercial TAC being set at 3 527 tons for the 2004/2005 season.

20 percent of the commercial west coast rock lobster TAC is allocated to the near shore fishery and 80 percent to the offshore fishery. Right-holders in the offshore fishery use larger and more sophisticated vessels than right-holders in the near shore fishery, and are permitted to catch rock lobster in traps. In the medium-term rights allocation process, right-holders in this fishery were granted allocations of more than two tons each.

The near shore fishery is restricted to using hoop nets in shallow water. It replaced the subsistence fishery in 2001 in keeping with the recommendations of an independent review of subsistence fishing in South Africa. The review recommended that high-value subsistence fisheries such as west coast rock lobster, traditional line fish and abalone should be commercialised. The commercialisation of these fisheries has permitted fishers to sell and market their products. Illegal harvesting remains an issue in both the nearshore and offshore fisheries.

5.1.6.1 West Coast Rock Lobster: Offshore

Sector Facts:

- TAC: 2200 Tons
- Jobs Sustained: 1058
- Gross Asset Value: R941 Million
- Number of Vessels: 105 vessels (excl 10 right holders who are to nominate alternative vessels)
- Number of Right Holders: 195
- Duration of Rights: 01 January 2006 to 31 December 2015

5.1.6.2 West Coast Rock Lobster – Near shore

Sector Facts:

- TAC: 20% of global WCRL TAC (~600 tons)
- Duration of Rights: 15 November 2005 to 31 July 2015

Extra ordinary or specific permit conditions include:

- The permit holder shall be responsible for the completion of the west coast rock lobster landing slips, or must appoint a representative to do so.
- The permit holder shall submit a certified copy of his or her audited financial statement to the Department of Fisheries.
- Certain permit holders are exempt from the requirement for a VMS. These include those permit holders operating with ring nets in Zones A and B, those fishing from vessels less than 5m in length, or with outboard capacity of 30Hp or less.
- Certain zones are demarcated as valid fishing zones, between certain times of year, with certain gear restrictions. These zone details are included in the permit. They

include the exact geographical location where fishing is permitted, the type of gear allowed, and the permitted landing sites.

- No transhipment of catches is allowed.
- The original permit must be on board and shall be produced on demand to a Fisheries Control Officer.
- Landing may only occur on weekdays between 8am and 4pm.
- All fishing gear must be removed from the fishing area and kept on board the vessel over weekends.
- Vessel operators may not land West Coast Rock Lobster for full and limited commercial rights holders simultaneously. The Fishery Control Officer must be notified before fishing for the limited commercial WCRL permit commences, and all rock lobster traps must be removed from the fishing grounds before the permit holder commences fishing for limited commercial WCRL permit holders.
- Tow/mother vessels must be clearly marked with the letters KK on both bows of the vessel. The permit holder shall affix the letter K on all vessels for the catching of rock lobster.
- No carrier vessels are permitted – the permit holder when using traps shall land his or her own catch.
- The Fishery Control Officer must be notified before 9am on a daily basis as to the movements of the permit holder's vessel. If the permit holders wish to start fishing before 8am they must notify before 4pm the day before.
- Commercial WCRL permit holders may not retain or use WCRL caught in terms of the permit for their own consumption.
- Vessels with deck grid sorters may not be used for the catching of WCRL.
- The permit holder shall ensure that all tagged west coast rock lobster caught and or tags collected or found are handed over to the local Fishery Control Officer for which a reward per tagged lobster and tag of R10 and R1 respectively will be paid.
- The permit automatically expires when the whole mass of WCRL is caught.
- Once the permit has expired, the permit holder shall immediately hand the permit over for cancellation, and remove all traps and ring nets from the sea.
- Each and every net/trap must be sorted and any under size lobster must be returned to the sea immediately.

5.1.7 Tuna Pole

This fishery primarily targets albacore (Thunnus alalunga), a pelagic species whose juveniles (<90 centimetres in length) typically form large schools near the surface of the water. Adult albacore occur lower down in the water column and do not form large schools and are therefore unavailable to the surface gear used by the poling fleet. In the Atlantic Ocean there are two stocks of albacore; the northern stock is separated from the southern stock at approximately 5 degrees N.

Albacore have a wide geographic distribution, occurring in all the major ocean basins. The South African poling fleet only operates along the west coast of South Africa, targeting the southern Atlantic albacore stock. Stocks of Indian Ocean albacore, which occur along the east coast of South Africa, are considerably less abundant. Large quantities of southern

albacore are also caught off the coasts of Namibia, Brazil and Argentina. Albacore are only caught in South African waters between October and June; the tuna pole fishery is therefore seasonal. The availability of the resource varies with environmental conditions which in some years concentrate fish and bring them closer to shore.

Due to their occurrence on the high seas, albacore are caught by many nations. The management of this species is the responsibility of regional fisheries management organisations ("RFMOs"), such as the International Commission for the Conservation of Atlantic Tunas ("ICCAT") and the Indian Ocean Tuna Commission ("IOTC"). The management of the stocks by the RFMOs are effected through stock assessments, the setting of Total Allowable Catches ("TACs"), the allocation of country quotas and the development of compliance and control measures.

The tuna pole fishery uses surface gear to target schooling juvenile albacore in the southeast Atlantic, largely for export to canning markets. Other tuna species that are landed include yellow fin and big eye tuna, but these species make up less than five percent of the annual catch. However, some right-holders have now started targeting these tunas for sale on the sashimi markets in Europe, UK, USA and Japan.

Southern Atlantic albacore has been commercially fished since the 1950's. Total landings fluctuated around 24 000 tons between 1965 and 1985; thereafter landings increased to approximately 30 000 tons.

The fishing nations that targeting albacore in the south Atlantic were: Taiwan (averaging 16 800 tons between 1998 and 2002), South Africa (6 200 tons), Brazil (4 000 tons) and Namibia (2 300 tons). The South Atlantic albacore stock is not over-exploited, despite catches exceeding the global TAC for several years.

As ICCAT has not issued country allocations for the South Atlantic albacore stock, the South African fishery is managed by the Department through a total applied effort ("TAE") of 200 vessels carrying a maximum of 3 600 crew.

Over the years, two types of vessels have emerged in this fishery. The first were large vessels with onboard freezers, capable of spending substantial periods at sea with a crew of 20 or more. The second type were smaller vessels that carried less than 20 crew, spending no more than five days at sea.

The fishery is not capital intensive, but locating and fishing for tuna using the pole method requires a skilled crew.

Sector Facts:

- TAE: 200 vessels and 3600 crew
- Jobs Sustained: 1729
- Investments in Fixed Assets (Insured Values): R125,m
- Number of Vessels: 103
- Number of Right Holders: 98
- Duration of Rights: 01 January 2006 to 31 December 2013

The allocation of long-term rights should encourage accurate reporting of landings. The poor historic data has been a problem in management of the industry till now.

5.1.8 Large Pelagic longline

South African participation in the long-lining sector is fairly new. The harvesting of tuna and swordfish by long-line was historically undertaken by Japanese and Taiwanese fleets, fishing in South African waters under bilateral licensing agreements. Participation by South African fishers in the large pelagics fishery, and in particular the tuna long-line and swordfish fisheries, was made possible by the 2002 decision not to renew the international fishing licenses of Japanese and Taiwanese long-line vessels in South African waters. These agreements terminated at the end of January 2003.

As a coastal state that has ratified the UN Fish Stocks Agreement, South Africa is obliged to develop and manage a fishery for large pelagic species in cooperation with the relevant Regional Fisheries Management Organisations' ("RFMO's") and in accordance with their existing management and control measures. The availability of tuna and swordfish stocks in South African waters, coupled with a renewed interest in the longlining of tunas by South Africans, induced South Africa to grant experimental tuna longlining permits in 1997.

Sector Facts:

- The fishery is effort rather than catch controlled. The total allowable effort (TAE) is 50 vessels (30 tuna directed and 20 swordfish directed)
- Current Number of Vessels: 17 tuna directed and 14 swordfish directed
- Number of Right Holders: 43 (26 tuna directed rights and 17 swordfish directed rights)
- Duration of Rights: 01 March 2005 to 28 February 2015

5.1.9 Summary Statistics: South Africa

Table 3.1.1: Summary Statistics Relating to Fisheries in South Africa

Species	TAC/TAE	%Black Owned	Jobs Sustained	No of Vessels	No of Rights holders	Duration of Rights
Hake Deep Water	124 500 tons	60%	8 900	79	46	1 Jan 2006 to 31 Dec 2020
Hake Inshore Trawl	9000 tons	54.4	1 480	31	17	1 Jan 2006 to 31 Dec 2015
Long-line Hake	11000 tons	91.3%	1 495	64	132	1 Jan 2006 to 31 Dec 2020
Hand line Hake (long-term rights)	5500 tons PMCL		342	39	39	1 Jan 2006 to 31 Dec 2013
Horse Mackerel	31500 tons PCML	47%	527	6	15	1 Jan 2006 to 31 Dec 2015
South Coast Rock Lobster	382 tons	71%	441	9	12	01 Oct 2005 to 30 Sep 2020
Patagonian Tooth Fish	450 tons	58%	83	2	5	1 Dec 2005 to 30 Nov 2015
Small Pelagics	202 000 tons sardine 212 251 tons anchovy	67.2% sardine, 68.2% anchovy	15 133	101	95	15 Jan 2006 to 31 Dec 2020
West Coast Rock Lobster (offshore)	2200 tons	64.7%	1058	105	195	1 Jan 2006 to 31 Dec 2015
West Coast Rock Lobster (near shore)	600 tons	90%				15 Nov 2005 to 31 July 2015
Tuna Pole	200 vessels, 3600 crew	52%	1729	103	98	01 Jan 2006 to 31 Dec 2013
Large Pelagics	30 tuna vessels, 20 swordfish vessels	84%	-	17 tuna, 14 swordfish	26 tuna, 17 swordfish	01 March 2005 to 28 Feb 2015

5.1.10 Analysis: South Africa

Depending on the completeness of its observer programme and its willingness to prosecute companies contravening regulations, South Africa has a chance of controlling negative behaviours such as over-fishing and dumping. The strict reporting of information by permit holders helps to keep accurate records and obtain good information as to the exact state of stock levels. This reporting may be an onerous burden for some permit holders, but its advantages far outweigh its potential costs, except where permit holders who were historically denied educational opportunities struggle to cope with requirements of the bureaucracy.

Certain control measures will enhance the industry's natural tendency to market concentration and vertically integrated oligopoly. Lump-sum application fees, and levies based on quota rather than catch, are problematic in this regard, though less significant in South Africa than in Namibia. The fishing companies have an incentive to spread such fixed costs over as large and valuable a catch as possible. Fixed overheads like these induce rent

dissipation by promoting excess effort, they also promote problematic practices such as high-grading. Pushing the costs of managing the resource onto permit holders, by making them pay levies and bear the costs of observers, is clearly regressive. The bigger producers can spread costs and risks more widely, and can add value further along the supply chain; levy costs are therefore a smaller proportion of their total revenues. On the other hand, shifting stock management costs onto permit holders should enhance efficiency in the industry, by favouring producers who are able to absorb these costs upfront.

State intervention to promote employment and black empowerment through the fisheries may also promote inefficiency, and engender a range of unintended consequences. At the simplest level, even with a fixed TAC, any increase in the number of quotas allocated would also increase monitoring costs, and probably increase pressures on fish stocks. More importantly, where a condition of quota allocation is investment in the industry, it forces small operators with little financial backing, into extremely vulnerable positions. Outside of the small-scale inshore fisheries, multiple quotas are now comparatively rare; small operators have a narrow range of species to target. With quotas and fish prices volatile, they are in a far riskier position now than they were historically. The allocation of long-term rights is a step towards solving this problem, but unless these are to some extent tradable, attempts to meet socio-economic concerns for the livelihoods of traditional fishery participants may only provide short-term benefits. There is a risk that participants will end up worse off and that efficiency will also have been sacrificed.

The permit system is accurate and detailed in its description of the restricted areas where fishing is not allowed. Modern electronic monitoring systems (VMS) track the locations of larger vessels. The permit conditions regarding by-catch are detailed, although the requirement that permit holders specify the actions they have taken to 'mitigate by-catch' is extremely vague, and does not indicate which options are regarded as appropriate.

The South African permits include restrictions on permissible gear, on the landing sites allowed, and on information requirements. While abiding by these may reduce the profitability of individual enterprises, they are intended to raise the viability of the industry as a whole. The problem is to design a system that maximizes the incentives for compliance without unduly raising operating costs (as would occur if monitoring and prosecution were the sole tools available)

Thus gear restrictions such as minimum mesh sizes, reduce by-catches and the catch of juveniles, while other restrictions can influence the ability to target high value by-catches (eg a ban on tickler chains to reduce the monkfish catch by the hake industry) and may also limit damage to the environment. Long-term local participants in the industry, and those who have invested in it, have more to lose from general non-compliance since, unlike short-term (vessel leasing) or foreign based operators, they do not have the option of easily shifting their capital elsewhere.

A common source of contractual problems is informational asymmetry. In the fishing industry this appears in many forms. In managing the resource, the state requires the fullest possible information on stocks, their age distributions and geographic locations. This information has clear commercial value to individual firms in the industry, who see it as a source of individual competitive advantage. More problematically, they may see strategic benefits from passing distorted information to the state. Individual profit maximising behaviour may run counter to the management regime's ideal of accurate information on fish stock levels. The restrictions on landing sites, and catch information requirements (e.g. the monthly submission of catch discharge sheets and trawl logs) may be onerous to the individual producer, but they provide industry wide benefits and help to ensure the sustainability of the fish stocks on which the

producer is reliant for further income. The ideal permit condition is one that gives the producer an incentive to comply with the regulator's need for information on fish stocks – while this would occur perfectly in a pure monopoly with long-term guaranteed property rights to the resource, a second best case is found where firms have a long-term property right in the resource rather than a short-term right to harvest. Long-term rights help align the producers' and managers' goals, and increase the likelihood that producers will cooperate with each other and the state in sharing information.

Contractual efficiency implies that there is no incentive to over-investment (a common cause of rent dissipation). The South African regulatory environment makes quota allocation dependent on catch history and boat size. If such "grandfathering" is anticipated in the future, it may encourage permit holders to over-invest. Again, the allocation of long-term rights reduces these incentives.

5.1.10.1 Hake Deep Sea Trawl

The issue of transhipment is another area in which the resource managers' need for reliable information on fish stocks and actual catches conflicts with producers' concerns for costs. Fisheries management needs to be able to account for all fish caught, landed, sold etc. Where transhipment at sea saves fuel and time it is individually rational. To be congruent with the needs of those regulating the industry, vessels transhipping their catches would need full time monitoring combined with GPS surveillance and scientific observers. This may become realistic as permits are increasingly structured to ensure these conditions while producers absorb the costs.

The permit does not state what should happen if a permit holder reaches the precautionary maximum by-catch limit before the end of the fishing season. Without a monitor on board, the permit holder may continue fishing, but may simply discard or high grade the by-catch species caught. On the other hand, rigorous monitoring and severe penalties for continued fishing after the by-catch limit has been caught, may force firms to leave quota uncaught and reduce profitability in the industry. One way around this problem is to require that all by-catch be landed, and recorded monthly, but only allow its sale up to the permitted limit (the remainder accruing to the state); alternatively maximum prices can be set on landed by-catches.

These issues are not currently a real concern to the hake industry, though they may be more important for the mid-water trawl (see below). In the trawl fishery, by-catch is now only checked annually! The current approach requires that Hake be more than 50% of the catch and that high-value by-catches such as kingklip and monkfish not exceed catches in the period 1998-2002. Otherwise, it is only the levy on by-catch that restricts the incentive to target it. Currently a working group is supposed to monitor by-catch and, should the limit be approaching and an overrun be anticipated, ensure that appropriate mitigation measures are adopted by the industry.

5.1.10.2 Hake Long-line

In the longline fishery the targeting of high value by-catch species was recognised as a problem early on when the sensitivity of the kingklip stock was demonstrated. By-catch is currently reported for each trip (rather than annually), and excess kingklip is confiscated to control the problem. Without adequate monitoring, the provision for no more than 8% kingklip by-catch on any one landing may simply result in fishers high-grading kingklip by-catch at sea. This provision does not align the incentives of fishers and fishery control, and may result

in undesirable outcomes such as discarding. Efficiency of producers may be affected by the restriction on other fishing activity while long-lines are set. The producer may waste resources moving from place to place to avoid kingklip catches, although one might expect the expertise of skippers to mitigate this resource waste. The information burden on long-line fishers is fairly high, but helps fishery controllers to follow the process with accuracy from the moment the fish is caught to its final processing.

5.1.10.3 Horse Mackerel Mid-Water Trawl

The permit condition requires that an observer be present at all times i.e. 100% monitoring of fishing activity. Monitors are rotated frequently to help maintain the integrity of the system. They cannot act to stop fishing, but should report back to fisheries management if any permit conditions, such as quota limits, are not adhered to.

Horse mackerel trawlers that have no hake quota are currently permitted a 2% hake by-catch. Fishing should cease once the precautionary by-catch limits have been exceeded. This puts a burden on the permit holder to synchronise catches of the targeted species, and the by-catch species in order to ensure that the by-catch "quota" or precautionary limit is not reached before the targeted species quota is filled. Such a contract offers strong incentives to high-grade by-catch, and is only tenable if reliable monitors are in place. One way around the problem, currently in use to a degree, is joint allocation of quota for mackerel and hake: i.e. to issue a portion of the annual hake TAC to mid-water trawlers, any hake by-catch then being deducted from the firm's quota.

5.1.10.4 Small Pelagics

One of the major challenges facing this fishery is over exploitation. One aspect of this is the difficulty is setting the TAC ahead of the season, these species are short lived and population levels are naturally volatile. Since these are schooling fish the costs of harvesting need not rise when the population falls, provided the existing shoals can be easily located. Consequently permit holders will have an incentive to over fish in order to recoup the costs of their capital investment if the TAC is reduced, especially if monitoring and penalties are inadequate.

Problems similar to those in the horse mackerel industry occur here, as anchovy permit holders who reach their pilchard by-catch limit must cease fishing immediately. Dumping is prohibited. This proviso demands high levels of skill to ensure that the quota is caught before the by-catch quota is filled. Without monitoring, the rational response of the permit holder is to over fish, and to discard by-catch.

The balance of market power between fishmeal processors, pilchard canners, and independent fishing companies, is influenced by the permit conditions. These dictate that, without prior permission, there be no splitting of catch between factories or landing points. Effectively this gives local processors a degree of monopsony power, making it tricky for vessel owners to "shop around" for the best prices. This may render some permit holders less efficient, although it is possible to deviate slightly from the 'one factory' proviso. Small Pelagics permit holders are also forbidden from activating any other permits concurrently. This may also impact on their efficiency, with extra fuel costs being incurred as they return to land the pelagics catch before going out again to fish other permits.

5.1.10.5 West Coast Rock Lobster

Accurate monitoring of effort and catches is necessary to prevent the over exploitation in the West Coast Rock Lobster industry. The recent case of Hout Bay Fishing Industries, a company that managed to seriously over-exploit both south and west coast rock lobsters with relative ease, shows the danger that poor monitoring can pose to fish stocks. The relatively large numbers of industry players, the existence of numerous artisanal fishers who have lost their access to the resource, the scarcity of alternative job opportunities for them, and the much lowered TAC, leave this industry vulnerable to excess effort.

5.2 Namibia: Rights Allocation Summary

Historically, the defining feature of the Namibian fishing industry was the peculiar status the country enjoyed prior to its independence in 1990. Following the First World War the former colony of German South West Africa became a League of Nations Mandated Territory, administered by South Africa. As a result, its zone of exclusive economic authority could not be extended to 200 nautical miles when the rest of the world's maritime nations extended their EEZ's. Although the South African Territorial Waters Act (87, 1963) extended direct control to 5 nm with a further 6 nm contiguous fishing zone, Namibia's offshore waters remained effectively open access. The consequence was heavy uncontrolled fishing by foreign (including South African) fleets. Major commercial species were exploited unsustainably and consequently collapsed. Post-independence in 1990, the Government management programme focussed on rebuilding these resources and shifting control from foreign to domestic hands. Stocks initially appeared to recover rapidly, however the small pelagic fishes have remained problematic; the pilchard stock collapsing suddenly in the late 1990s, and the hake catch showing signs of stress a few years later, with declines in both catch per unit effort and average fish size.

Horse mackerel has become the most important species in Namibia in volume terms while hake is most important financially. A major current challenge in both industries is the small average size of fish landed. Namibian mackerel are generally smaller than those landed on the South African South Coast, or those landed in Namibia historically. Small fish sizes reduce the options available for the use of the catch, and its value per ton.

After independence, the Namibian Government stipulated three objectives for its fishery policies: (a) rebuilding fish stocks by basing management policies on sound research; (b) Use of taxes and levies to induce Namibianisation; and (c) use of fishing rights allocation to empower previously disadvantaged Namibians. Fishing rights of five, seven and ten years were allocated in 1994. In 2001, these were changed to long-term rights of seven, ten, fifteen and twenty year rights, to encourage investment. The number of years awarded to the rights holder depends on the amount of Namibian ownership, local investment in onshore facilities and vessels, local employment, and the introduction of innovative fishing related-activities (technology, markets, etc.).

Namibian fisheries policy has targeted on-shore handling and processing: importantly, hake quotas are allocated independently for freezer trawlers and wetfish vessels, with an emphasis on the latter which use shore labour more intensively.

Unlike Angola and South Africa, the majority of Namibian fisheries are commercial, industrial scale and export directed operations. Artisanal fishing is not a serious feature of the industry,

and domestic consumption of fish is low. Relevant sectors are: the hake demersal trawl and long-line, monk and sole demersal trawl, small pelagic purse-seine, large pelagic (pole and long-line), the horse mackerel mid-water trawl, deep-sea red crab and the west coast rock lobster. The sources of information used in the following analysis of the rights holders and fishing vessels include:

- a rights holder survey carried out specifically for the BCLME project in 2004;
- Namibian Ministry of Fisheries and Marine Resources (MFMR) fisheries database;
- Namibia Fishing Industry Online database (www.nfi.com.na);
- Fishing Industry Handbook, G. Warman Publications, Cape Town (various editions)
- Information supplied by MFMR on request.

5.2.1 Small pelagics

Contractual issues in the Namibian small pelagics industry date back to the1948 sealing and fishing ordinance which required registration and licensing of all fishing vessels and processing plants, and introduced controls on total catch, closed seasons, etc. Shortly after its introduction rudimentary effort controls were attempted and vessel numbers restricted to 24 vessels per company and a maximum processing capacity was imposed on the processing plants. A closed season was also introduced, precluding fishing during the post-spawning period when fish would be in poor condition and oil yields low. The conventional problems of such crude effort controls (e.g. over-capitalisation through measures like increases in vessel size) were mitigated by introducing a Total Allowable Catch (TAC) which was supposed to be fined-tuned iteratively over time.

Catches were controlled until 1959; thereafter pressure rose for an increased TAC. From approximately 225 000 tons in the 1950s, it was increased to approximately 650 000 tons in the mid-1960s while actual catches rose to over one million tons in 1967 and over 1.5 million tons in 1968. This period also saw the return of some factory vessels for the processing of pilchards, though these disappeared again in 1970.

Pilchard Catch per Unit Effort (CPUE) peaked in the early 1960s, dropping steadily thereafter as recruitment fell and off-takes increased. When the decline became obvious, fishing companies were encouraged to diversify out of pilchard and into other small pelagic fishes, particularly anchovy. Mesh sizes were also effectively changed as 11 cm anchovy nets were introduced, introducing the problem of a juvenile pilchard by-catch. However, anchovy catches decreased substantially during the 1990s and very little anchovy is currently caught off Namibia. (TACs of twenty thousand tons in 2003 and twenty five thousand tons 2004 and 2005 were all that was allocated)

Currently the Namibian small pelagic fishing industry is controlled by the setting and monitoring of pilchard TAC. Closed seasons and by-catch restrictions are implemented as additional management measures. As with all Namibian quotas, there are penalties for failure to land the amount specified in the permit. A zero TAC is therefore a benefit and not a problem for firms when stocks are (as currently) depressed and CPUE is extremely low.

5.2.1.1 Rights holders

The current state of the resource and the probability of a zero TAC (as happened in 2002) in the next season, means that referring to the 2006 season is of little value, examples are therefore taken from 2003. The Namibian small pelagic fish (pilchard) TAC is divided amongst 22 rights holders. Compared to the South African small pelagic industry, quota is allocated relatively evenly amongst the rights holders. Only one company (GAB Fishing Enterprises, a joint venture company) had an allocation of more than 2000 tons for 2003; 50% of rights holders received between 1000 – 1500 tons, 36% received between 500 – 1000 tons, and only two companies received less than 500 tons. There was no apparent relationship between the size of allocations and the duration of rights; 32% were for seven years, 32% were for 10 years and 36% were for 15 years. No 20-year rights were awarded, these being reserved for companies that have both completed 15 years in the industry, and employ more than 5000 employees in onshore processing operations.

Five of the rights holders are joint venture companies: GAB (Namsea, Namfish and Anibib), Auob-Eigelaar (Auob Fisheries and Eigelaars Belange), Champion Ladies (Champion Fishing and Ladies Fishing), Genmir Marine Resources (Gendev Namibia and Mirabilis Marine Resources), and Meyiga Fishing Industries (Namchild and Edelweiss Visserye). The rest are private companies. Two of the companies involved in the GAB joint venture (Namfish – Namibian Fishing Industries Limited and Namsea – Namibian Sea Products Limited) are listed on the Namibian Stock Exchange.

Of the four rights holding companies reported to have small pelagic fish processing facilities in 2003 (Fishing Industry Handbook, 2004) only two factories were active in 2005. These were the Etosha Fishing Corporation and United Fishing Enterprises (part of the Namsea group) factories. The small pelagic fish processing factories employed some 3000 people before the closure of the pilchard fishery in 2000. When two of the factories reopened in 2003, they only re-employed approximately 900 (mostly seasonal) workers. Recently (2005), United Fishing Enterprises announced their intention to implement further retrenchments of staff.

5.2.1.2 Vessels

The number of vessels participating in the small pelagic purse seine fishery has been declining steadily over the last few years. Some 45 vessels were active in the fishery in 1990; only 14 purse seine vessels were fishing for small pelagic fishes in 2003

The Namibian vessels are almost twice the size of their South African counterparts, but have similar crew complements. All the crewmembers of the small pelagic fleet are Namibian nationals. Therefore, some 175 Namibians are employed as seagoing crew on the purse seine vessels.

All the vessels are locally owned and are operated under Namibian flags. Ten of the vessels are owned by or are in joint ventures with fish processing operations; four are independent operators. All of the vessels operate out of Walvis Bay. In the 1960's the fishery was localised around Walvis Bay, but it now extends from north of Luderitz to just south of the Cunene River.

Table 5.2.1. A summary of some mean characteristics for vessels making up the Namibian small pelagic fish purse seine fleet.

CHARACTERISTIC	TOTAL FLEET
Length (m ± Std Dev)	45 ± 4
GRT (tons ± SD)	443 ± 132
Horsepower (kW ± SD)	1234 ± 535
Crew (± SD)	13 ± 2
Construction Year (± SD)	1966 ± 5
% Local Flag	100%

5.2.2 Mid-water Trawl (Horse Mackerel)

By volume, the mid-water trawl fishery for adult horse mackerel is the largest sector in the Namibian fishing industry. The fish was first targeted in this manner in the early 1960's; when annual catches in the region of 50 000 tons were first recorded. By the 1980's this volume had risen by an order of magnitude to 500 000 tons per annum, taken mainly by foreign fishing vessels from Cuba and Eastern European countries. After Namibian independence, the TAC was set at 465,000 tons, and has in subsequent years varied between 200,000 - 400,000 tons. It should be noted that the TAC includes both the mid-water trawl and purse seine fisheries. Horse mackerel catches in the mid-water trawl fishery stabilised within the 300 000 – 350 000 tons per annum range.

The demand for horse mackerel began with an emphasis on dried and salted fish; however, the proportion processed in this way fell till by 2000 only a small proportion was salted and dried on shore, mainly for the Congolese (DRC) market. Currently most of the landings are processed directly on board and exported as a whole, round, frozen product to other African countries. The main reason for the discontinuation of the drying industry was that the market had experienced an economic downturn and no longer demanded the same quantities as it had historically. Today there is no large-scale production of dried and salted horse mackerel in either South Africa or Namibia; however, the recent availability of alternative cheap fish (e.g. blue shark) has allowed some revival of commercial fish drying.

Management measures for horse mackerel include an age-structured production model to assess the biomass stock, by-catch and minimum size restrictions, closed areas and minimum cod end mesh sizes are also being implemented. A global TAC of 350 000 tons of horse mackerel was set for Namibia's 2003 fishing season.

5.2.2.1 Rights holders

There are currently 13 rights holders in the Namibian mid-water trawl fishery. All of the participants have 10-year rights, except Namsov Fishing Enterprises, which has a 15-year right. Namsov also has the largest portion, with more than 23% of the total allocation in 2003. The industry is highly concentrated, the top five companies owning 62% of the horse mackerel allocation. The rest is divided into portions of about 5.5% (three rights holders) or 4.5% (four rights holders), and one rights holder with about 4.0% of the allocation.

5.2.2.2 Vessels

With the recent problems experienced in the Namibian small pelagic fishery, and the subsequent targeting of horse mackerel by some of the small pelagic fleet, it is becoming increasingly difficult to determine which vessels are dedicated mid-water trawlers, targeting the Namibian adult horse mackerel resource exclusively. The defining characteristic of the Namibian mid-water trawl fleet is the presence of leased Russian or formerly Russian vessels. These large vessels have been introduced to the fishery in an attempt to cut harvesting costs through economies of scale. The average length of the vessels operating in the 2003 -2004 season was about 100m; the largest vessel was 110m and the smallest was 55m. Twenty percent of the vessels listed were still registered in Russia; the majority (almost 62%) were registered under the popular "Flags of Convenience" for fishing vessels (i.e. Belize and St Vincent & the Grenadines). Only one vessel was registered in Namibia.

The mid-water trawl fleet is made up of relatively modern vessels; the average year of construction was 1984, compared to an average of 1976 for the entire Namibian fishing fleet, across all fisheries.

Table 5.2.2. Namibian horse mackerel mid-water trawl fleet: mean characteristics.

CHARACTERISTIC	TOTAL FLEET
Length (m ± Std Dev)	97 ± 16
GRT (tons ± SD)	4273 ± 1571
Horsepower (kW ± SD)	4163 ± 1390
Crew (± SD)	68 ± 21
Construction Year (± SD)	1984 ± 6
% Local Flag	5%

The size of the crew varied considerably, ranging from 40 to 80 members. The total number of sea-going crew employed by the mid-water trawl industry was in excess of 1425 people during the 2003-2004 season; however, only about 19% were Namibian nationals. The issue of the "Namibianisation" of this fishery is being addressed, with rights holders undertaking to train and employ more Namibian crewmembers on these vessels.

5.2.3 Hake demersal trawl and long-line

The hake fishery is currently the most valuable in the Namibian fishing industry. Like the South African hake fisheries, it is based on two species; the shallow water *Merluccius capensis* and the deeper water *M. paradoxus.* The shallow water species is more common in Namibia, with the presence of *M. Paradoxus* in the trawl catches increasing to the south. In South Africa, the deep-water species is more commonly trawled. A third species, the Angolan hake *M. polli* occurs north of the Kunene River, and is occasionally present in Namibian trawl catches in the north.

Prior to independence in 1990, the fishery was largely in the hands of South African vessels and foreign distant water fleets and managed by the ICSEAF from 1972 until 1990. Hake catches peaked in the early 1970s, with the ICSEAF figures suggesting a harvest of 820 000 tons in 1972. By the late 1970's the stock had declined sharply. Even so, during the 1980's approximately 200 000 - 350 000 tons of hake were taken from the Namibian waters per annum.

Post-independence conservatism led Namibia to reduce its hake TAC to 55 000 tons in 1991. The TAC was subsequently steadily increased, with the 1999 – 2000 TAC being set at 210 000 tons. In 1999 the annual TAC (January – December) was replaced by a seasonal TAC (May – April). Recently, the TAC has been adjusted downwards, and was set at 180 000 tons for the 2003 – 2004 season. Once Namibia gained control of the fishery, demersal hake rapidly replaced the small pelagic fishery as the dominant sub-sector of the Namibian fishing industry. Unfortunately, falling prices (caused by small sized fish and a strong currency) have weakened the industry in the recent past.

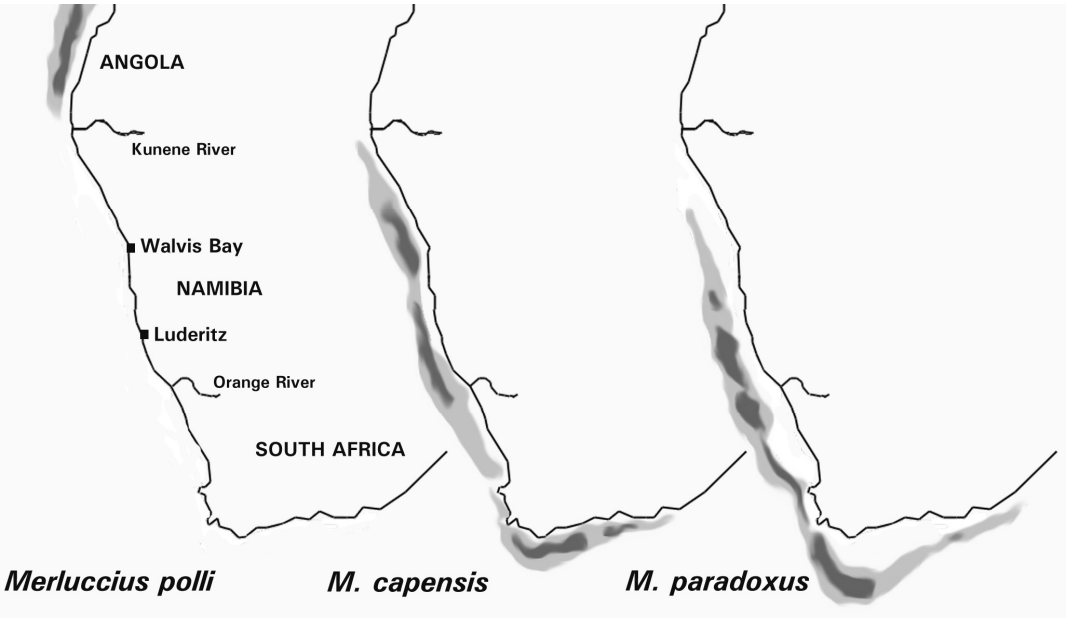


Figure 5.2.1. Approximate distribution of the three hake species in the BCLME.

The hake fishery is managed through TAC control with access limitation through an individual (non-tradable) quota property rights system. Other management tools include area and by-catch restrictions, mesh size regulations and the implementation of selectivity devices, a system of fees and levies, as well as monitoring, control and surveillance activities.

5.2.3.1 Rights holders

The hake demersal trawl and long-line industry is the largest in the Namibian fishing industry, in terms of rights holder participation. The 38 hake rights holders make up nearly a quarter of all rights holders in the Namibian fishing industry. Some of these rights holding entities are joint ventures between a number of companies, further broadening the level of participation. Just after Independence, only 17% of the hake resource was in Namibian hands; recently Nichols (2004[21]) reported that approximately 96% of the hake quota was controlled by Namibian entities.

In 1992, Namibia began the policy of Namibianisation of its domestic fisheries, including the promotion of land-based infrastructure and employment. In the hake demersal trawl fishery,

[21] Nichols, P. 2004. Marine Fisheries Management in Namibia. In Sumaila, U.R., Boyer, D., Skogen, M. and Steinshamn S.I. Eds. *Namibia´s Fisheries: Ecological, Economic and Social Aspects.* pp 319-332. Eburon, Delft.

this policy was promoted through the apportionment of hake trawl quotas as either "wetfish" (60% of TAC and later 70%) or "freezer fish" (40%, later 30%). As well as receiving the greater portion of the TAC, the wetfish sub-sector also paid lower levies. Unlike South Africa, Namibia sets aside no dedicated long-line hake quota. Long-line vessels are allowed access to the hake fishery by fishing against a wetfish quota allocation.

The Namibian government's decision to fix the wetfish/freezer trawl ratio is contentious, and there have been calls to review it. The freezer fleet in Namibian waters tends to be more profitable than the wetfish fleet, but the margin is variable. Wetfish trawlers are less susceptible to high oil prices and present advantages when catches contain a higher proportion of large fish. Freezer trawl quota is more valuable than wetfish quota, indicating the greater current profitability of this technology, despite the larger quotas and greater flexibility of processing options that come with land-based processing of hake caught by wetfish vessels. However, the recent decline in catches, the smaller size of the fish being caught, overcapacity of both wetfish vessels and land-based processing factories, and the strength of the Namibian dollar, have led to severe financial tension in the wetfish sub-sector (Japp, pers comm.[22]).

The hake rights holding entities are mostly based in the Walvis Bay / Swakopmund region (52%), followed by Windhoek (31%), with only 15% from Luderitz.

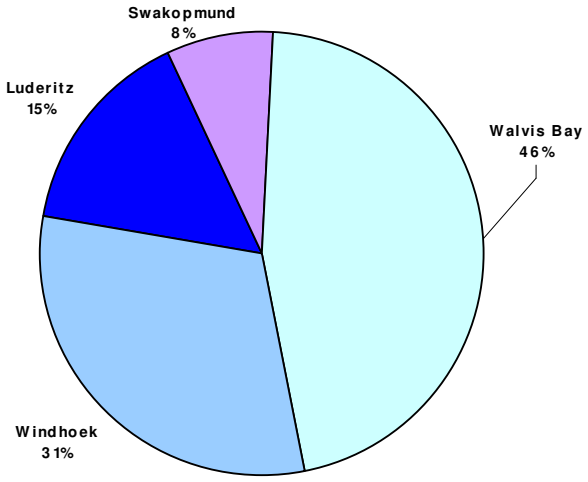


Figure 5.2.2. Locations of hake demersal trawl rights holders: Namibia 2003 – 2004.

Of the 15 factories recorded in the 2004 survey as servicing the hake industry, 60% were located in Luderitz and 40% were in Walvis Bay. An estimated 3750 permanent staff and an additional ± 1000 seasonal staff (total 4750) were employed by the hake processing factories in 2004. Currently the industry is under stress and is in the process of restructuring.

5.2.3.2 Vessels

Of the 140 or so vessels fishing in the Namibian demersal hake fishery in 2003 – 2004, approximately 69% were based in Walvis Bay, and 31% in Luderitz. Analysis of hake fishing effort by Japp (pers comm.) indicates that the freezer vessels generally steam south from

[22] Dr David Japp, Fisheries & Oceanographic Support Services CC, Cape Town, South Africa

Luderitz and Walvis Bay to fish at latitudes of between 24°S – 28 °S. The wetfish and long-line vessels tend to fish closer to their home port as they need to return to port to offload and process their catch on land. The Luderitz vessels head south towards the South African border, whilst the Walvis Bay wetfish and long-line vessels fish between latitudes 19 °S – 22 °S.

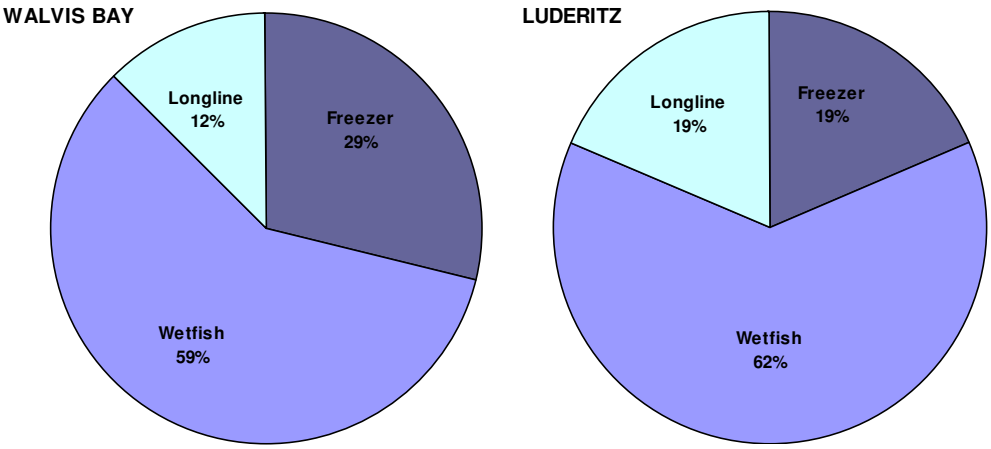


Figure 5.2.3. Demersal hake fishing fleet at Walvis Bay and Luderitz: percentages of freezer, wetfish and long-line vessels.

The characteristics of the three types of vessels are summarised in Table 5.2.4. At first glance, it appears that size is a defining characteristic of the three types of vessels. However, closer analysis of these characteristics (e.g. vessel length, in Figure 3.2.15) shows that two distinct types of freezer vessels are present in the hake fishing fleet. There is group of smaller vessels (mean length = 32 ± 5 m), comparable in size to the smaller wetfish and long-line vessels, and a group of larger freezer vessels, almost twice the size (mean length = 67 ± 11 m). The wetfish trawlers are a relatively diverse group, most ranging in length from 20 – 60 m. The long-line vessels are more homogeneous, with 80% of the vessels falling in the 15 – 35 m length range.

The process of Namibianisation is well advanced in the hake fleet. At least 81% of the trawlers and 90% of the long-liners were registered as Namibian vessels (Table 5.2.4). Most (± 85%) of the approximately 3822 crewmembers employed on the vessels in 2003 – 2004 were Namibians.

Table 5.2.4. Namibian demersal hake fleet 2003 – 2004: mean characteristics of freezer trawlers, wetfish trawlers and long-line vessels.

Characteristic	Freezer Fleet	Wetfish Fleet	Long-line Fleet
Length (m ± Std Dev)	55 ± 20	40 ± 13	30 ± 9
GRT (tons ± SD)	1071 ± 759	529 ± 343	229 ± 173
Horsepower (kW ± SD)	1814 ± 771	1242 ± 567	636 ± 374
Crew (± SD)	43 ± 20	21 ± 10	24 ± 5
Construction Year (± SD)	1980 ± 10	1980 ± 11	1974 ± 14
% Local Flag	82%	81%	90%

Table 5.2.5. Namibian employment on vessels: demersal hake fishery in 2003 -2004.

Vessel type	Total crew	Namibian crew	% Namibian crew
Freezer trawler	1630	1356	83.2%
Wetfish trawler	1727	1455	84.3%
Long-liner	465	423	91.0%
Total	**3822**	**3234**	**84.6%**

5.2.4 Monkfish and sole demersal trawl

These high value species are not important as straddling stocks, but are relevant to the hake industry.

Until 1994, monkfish were caught off Namibia as by-catch in the hake demersal trawl fishery. In 1994 the Namibian government opened a monkfish-directed fishery, with a hake by-catch. Provision for a sole directed fishery was included in the new monkfish legislation.

The monkfish fishery was effort-controlled till 2001; the effort restrictions were two-fold; power restrictions on the vessels (≤ 800 HP) and a limit to the number of vessels operating in the fishery. With the subsequent increase in boats targeting monkfish the catches increased to more than 12000 tones in 1994. Despite its establishment as a separate fishery, the hake demersal trawlers were still taking up to 30% of the total monkfish landed as by-catch.

Approximately 12000 tons of monkfish were landed on average between 1994 and 1997. Record landings of around 17000 tons where attained during 1998 with landings decreasing again to around 14000 in 1999. In 2001 the management procedure for monkfish was changed from an effort controlled fishery to a quota managed fishery. Initially the quota for the 2001 fishing season was set at 13000 tons but was adjusted to 12000 tons for the 2003 - 2004 and 2004 – 2005 fishing seasons. The TAC is a global one, and must be shared between the monkfish-directed and the hake-directed fisheries. Other control measures include a minimum trawling depth and minimum mesh size (75 mm for the trawl net's cod-end). Even so, the majority of the fleet uses a (hake net) mesh size of either 110 or 120mm.

5.2.4.1 Rights holders

There are nine rights holders in the demersal trawl monk and sole fishery. The total quota allocated to the rights holders from the global monkfish TAC was about 11 400 tons (95%) for 2003 – 2004.

The quota allocations were not evenly distributed between participants, with one firm, Frebeca Fishing (Pty) Ltd. receiving 47% of the total monkfish-directed allocation.

5.2.4.2 Vessels

Most of the monkfish quota is caught by freezer trawlers (representing 89% of the fleet). The fish is processed (headed and gutted) and frozen at sea. However, the Frebeca joint venture uses two wetfish trawlers, in addition to freezer trawlers, to catch its quota. The catch from these vessels is processed by Calidu Fishing (Pty) Ltd, a multi-species (although primarily

hake) processing factory. The Frebeca group also has a dedicated shore-based monkfish trimming and packing factory, Benguella Sea Products. The frozen monkfish tails are exported to Europe.

The demersal trawl vessels targeting monk fish are significantly smaller than the hake-directed demersal trawlers. The monk fish freezer vessels are nearly half the length of their hake counterparts. The majority (61%) of the monkfish-directed trawlers have a horse power rating of 800 kW or less, dating back to the time when the fishery was Effort-controlled.

Table 5.2.6. Namibian monk and sole fishing fleet 2003 – 2004: mean characteristics of demersal trawl vessels.

Characteristic	Total Fleet	<801 kW Horse Power vessels	>800 kW Horse Power vessels
Length (m ± Std Dev)	29 ± 5	27 ± 4	33 ± 5
GRT (tons ± SD)	247 ± 113	182 ± 48	350 ± 109
Horsepower (kW ± SD)	857 ± 279	688 ± 114	1121 ± 255
Crew (± SD)	17 ± 5	16 ± 4	19 ± 5
Construction Year (± SD)	1978 ± 11	1975 ± 11	1984 ± 9
% Local Flag	100%	100%	100%
Number of vessels	18	11	7

The number of vessel-based employees in the monk and sole fishery in 2003 -2004 was approximately 305 crew members, of which 93% were Namibian nationals. Total employment (land and vessel-based) resulting from the monk and sole fishery alone is probably in the region of 350 people, but this is difficult to estimate due to the cross-linkages with employment in the hake fishery.

5.2.5 Cape (West Coast) rock lobster

In the late 1950s over 4000 tons of rock lobster was being harvested per year. By the 1960's the figure had risen to over 8000 tons per year. Exploitation at this level was not sustainable and the catch began to drop off considerably. At independence, the Namibian government set a generous TAC of 1200 tons for rock lobster (in 1991), but only about 375 tons were caught. The following year the TAC was drastically cut to 100 tons. Over the next 10 years the TAC was gradually increased until 400 tons was reached in 2001, as stocks began to recover, nevertheless, rights holders have struggled to fill their quotas. The rock lobsters have not recovered as quickly as anticipated; In the White Paper of 1991[23] the Ministry expected the stock to reach an annual TAC of 500 tons over a period of five years and 2000 – 3000 tons annually in the long-term. The rock lobster TAC for the 2003 – 2004 fishing season was 405 tons.

Apart from the TAC allocations, other management measures include effort restrictions, closed areas and closed seasons.

5.2.5.1 Rights holders

The rock lobster TAC is apportioned between 21 rights holders. Quota allocations for the 2003 – 2004 season are recorded in Table 5.2.7. Three entities (14% of the rights holders)

[23] The White Paper on Fisheries Policies. 1991 "Towards the Responsible Development of the Fishing industry in Namibia."

had 48% of the allotted TAC for the year (Figure 3.2.23). Among these was the Seaflower Lobster Corporation which also has the largest lobster factory in Luderitz, processing some 66% of the entire annual catch. It is also one of the original lobster operations in Luderitz, and is a subsidiary of the National Fishing Corporation, a government owned entity. It has been noted earlier that the more monopolistic the structure of a fishing industry, the greater the implicit incentives for it to be run efficiently and sustainably. Competition, especially open access competition, is the foundation of most rent dissipation. The significant levels of vertical integration and monopsony power in this industry should not, therefore, be seen as sources of concern.

Table 5.2.7. The rights holders in the Namibian west coast rock lobster fishery, and their quota allocations for 2003 - 2004.

RIGHTS HOLDERS	DURATION OF RIGHT (Years)	ROCK LOBSTER ALLOCATION (KG)
Aloe Fishing Co. (Pty) Ltd	10	40000
Andrews, S	15	12000
Atushe Lobster Co. (Pty) Ltd	15	65000
Blohema Fishing (Pty) Ltd	15	12000
Epoko Fishing Co. (Pty) Ltd	15	12000
Golden Horizon Fishing JV	15	12000
Kakoro, H	15	12000
Lawrence, JA	15	12000
Luderitz Pioneers (Pty) Ltd	15	10000
Martins Den Fisheries	15	12000
Omulonga Fishing Co. (Pty) Ltd	15	12000
P.R.I.M. Fishing	15	12000
Plaatjie, A	15	12000
R & FO Fishing (Pty) Ltd	15	12000
R.P.M.G. Fishing	15	12000
Schoombe, D	15	12000
Schroeter, JA	15	12000
Seaflower Lobster Corporation Ltd	15	88000
Shoremillkol (Pty) Ltd	15	10000
Victor, D	15	12000
Von Ast, RI	15	12000

Almost all of the west rock lobster rights are long-term (15 years). Only Aloe Fishing Company (Pty) Ltd was awarded a medium term (10 year) right.

5.2.5.2 Vessels

Like the South African rock lobster fishery, the Namibian rock lobster resource is targeted using both rigid traps deployed from trap-boats and hoop-nets from dinghies. However, unlike South Africa, where the TAC is split between the inshore (hoop-net) and offshore (trap) sub-sectors, in Namibia quota is unrelated to the technology used to harvest. Although the vessels operate from Luderitz, the fishing grounds are some distance away. There are three fishing areas, based on their location to Luderitz; south, which is about 12 hours steaming from port, central (± 3 hours) and north (4 – 7 hours). The trap-boats carry or commonly tow 2 – 4 dinghies to the fishing grounds. The traps are deployed offshore, and the dinghies are then towed inshore, where they deploy their hoop-nets. The Namibian rock lobster trap-boat fishing fleet for the 2003 – 2004 season had 39 vessels, the average vessel

being 33 years old. It is an ageing fleet, however, the current state of the resource does not warrant recapitalisation.

5.2.6 Deep-sea red crab

The red crab (*Chaceon maritae*) is a deep sea species found on the continental shelf off Namibia, from north of Luderitz all the way up the west coast of Africa to Cote d'Ivoire. The Namibian fishing grounds are located between latitudes 17°15' to 21°00' South, in waters from 500 to 800 m deep.

The deep sea red crab fishery first started off the coast of Namibia in 1973, when three Japanese vessels began to target the resource. Their success attracted other operators, and by the end of 1974 the fleet had grown to 17 vessels. Catches peaked at approximately 10 000 tons in 1983, but this level of exploitation was unsustainable, and the annual landings declined to 3000 tons in 1991. Management of the species by Total Allowable Catch was introduced in 1989, but the initial TACs of 6000 tons were unrealistically high. Catches remained below 3000 tons per annum, and the TAC was adjusted downwards to 2000 tons in 1997. Although there have been minor fluctuations, the TAC remains at roughly this level.

The TAC is based on length-based cohort analyses from catches and biomass surveys and growth rates established by tag, release and recapture. The deep sea red crab fishery is also managed by the use of minimum size limits (≥ 85 mm carapace width) and the exclusion of fishing at depths shallower than 400 m. The stock is shared between Angola and Namibia, who have initiated joint research activities and stock assessments.

Females red crabs migrate between the Namibian and Angolan fishing grounds, probably to spawn. Although some trawling of the species occurs in Angola, the Namibian stock may only be fished using traps. A rights holder who catches red crab in both territorial waters has noted that the Namibian crabs are on average larger than the Angolan crabs, indicating that the Angolan stock is overexploited; possibly through illegal trapping or unlicensed trawling.

5.2.6.1 Rights holders

The Namibian deep sea red crab fishery was developed and has been exploited by Japanese fishing companies since 1973. A local company entered the fishery with two vessels in 1976, but withdrew in 1979. After independence, when Namibia's current system of fishing rights was instituted, the two traditional Japanese companies (AMSTAI and Oshimada Fishing) took on local shareholders and were awarded red crab quota under the new dispensation. Aquamarine Fishing, a Namibian company, was also awarded quota, in 1993 though it does not directly participate in the industry in which only two vessels were actively fishing in the 2003 – 2004 season. Of the three rights holders currently active in the fishery, two have 10-year rights and one has a seven-year fishing right. The combination of long-term rights and effective monopoly can keep the industry's contract with the state efficient provided the industry participants see themselves benefiting in the long-term from present attempts to conserve the resource. Long-term rights are a help in this regard, but security of property rights and options for their renewal are also factors.

5.2.7 Large pelagics

The large pelagic fishery is a relatively new, multi-species industry, targeting tunas, swordfish and pelagic sharks using pelagic long-liners and pole & line vessels (also called bait-boats). The Namibian-controlled large pelagic fishery only started in 1991, after independence,

although foreign long-liners had been catching tuna in Namibian waters under South African licence for many years previously. The fishery has been evolving since its inception. Initially, southern albacore tuna, (*Thunnus alalunga*) was the target species using pole & line vessels. During the 1990's a combined fleet of about 30 local and foreign-owned pole & line vessels caught between 1000 – 3500 tons of tuna per annum using this method.

In 1993, foreign pelagic long-liners started targeting big-eye tuna (*Thunnus obesus*) in Namibian waters, for the high-value sashimi market. The catches for this component of the tuna fishery were highly variable, ranging from 15 - 750 tons per year.

The Namibian tuna fishery developed into the "large pelagic" fishery when swordfish and pelagic sharks were included. The swordfish component developed from an experimental fishery that was initiated in 1996, using pelagic long-liners. Although initial catches were poor (± 50 tons over three years), they increased to 730 tons in 1999. In 2003, swordfish catches dropped to about 190 tons for the year.

Table 5.2.8. Namibian large pelagic fishery post-independence: annual catch by species (Source: Fishbase- South East Atlantic Capture Fisheries, FAO 2005).

Species	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Albacore	-	2,24	3,52	3,07	1,86	1,52	1,20	1,43	1,16	2,42	3,42	2,96
Big-eye tuna	-	-	-	751	352	63	46	16	423	589	640	312
Sharks	-	-	-	-	-	-	-	-	-	-	-	794
Swordfish	-	-	-	-	-	-	-	-	730	469	751	744

The fourth component of the Namibian large pelagic fishery is that of the pelagic sharks. Blue and mako sharks are targeted by pelagic long-liners. Recently sharks have become the largest component of the Namibian pelagic long-liner catches; being almost double the tuna and swordfish catches combined.

Table 5.2.9. A comparison of total catch for the fishes making up the large pelagic fishery, by long-line and pole and line vessels, in 2003 source: NFI, 2006[24]).

Component	Long-line catches (tons)	Pole and line catches (tons)
Tuna	982	2,389
Sharks	1,853	682
Swordfish	178	13
Other	152	109

Currently (2004 – 2005 season), the pelagic long-line fleet targets mainly sharks and swordfish (± 40% each of the total catch), with yellow fin tuna, big-eye tuna and marlin making up the rest of the catch. The pole & line fleet catch is currently made up almost

[24] Namibian Fishing Industry website, www.nfi.com.na/recent_stats.html

entirely of albacore (long-fin tuna), mainly caught in the vicinity of the Tripp Seamount, with peak catches in March and April.

Namibia has been a full member of the International Convention for the Conservation of Atlantic Tuna (ICCAT) since 1999, and all participants in the large pelagic fishery are required to abide by ICCAT regulations. Approximately 4000 tons of tuna were allocated to Namibia from the global tuna TAC for the south Atlantic region. In 2002, the Namibian government managed to secure an ICCAT country quota of 890 tons for swordfish, escalating to 1140 tons in 2006.

Aside from the ICCAT country quota allocations for tuna and swordfish, other management strategies in the Namibian large pelagic fishery include an ICCAT catch documentation scheme, gear restrictions (pelagic long-line and pole & line fishing only) and effort limitation through controlling long-liner vessel access to the fishery. Pole & line fishing vessels have been pressed to add value to their catch through onshore processing. While long-line caught tuna is exported fresh, pole & line caught tuna is used for canning. Canning took place in Walvis Bay between 1993 and 1997 but was then discontinued, with the tuna being canned abroad thereafter.

5.2.7.1 Rights holders

The majority of the rights holders are based in Walvis Bay (76%); the rest are in Luderitz 24%). The durations of the large pelagic fishing rights are summarised below:

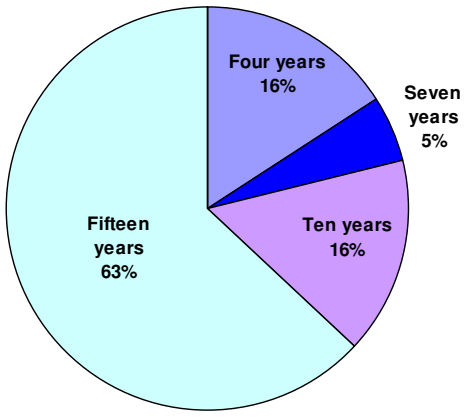


Figure 5.2.4. The percentage of large pelagic rights holders with four, seven, ten and fifteen-year fishing rights, during the 2003 – 2004 fishing season.

5.2.7.2 Vessels

While South Africa's tuna fleet has moved away from long-lining, Namibian large pelagic rights holders have tended away from poling and towards long lining. The pole & line vessels currently operating in Namibian waters are mostly foreign (approximately 20 vessels, mainly South African) fish under some form of catch agreement with the local rights holders.
The pole & line fleet consists of two distinct groups. The first contains large Asian flagged vessels of approximately 50 m in length; the second consists of smaller, southern African flagged vessels ranging in length from 19 – 29 m.

Most (95%) pelagic long-line vessels fall between 15 – 35 m in length. The one large (> 45 m) long-line vessel operating in the fishery is Japanese. Total vessel-based employment for the long-line fleet was about 805 crew members, of which 70% were Namibian citizens. It is more difficult to estimate the total number of pole & line crew members, without the details of the South African based vessels in the fishery, and their Namibian crew component. For the Namibian based vessels, there were approximately 140 crew members, of which 42% were Namibian nationals. Assuming that the South African fleet consisted of vessels similar to the Southern African flagged pole & line vessels in Table 5.2.10 (average crew = 22 members), there must have been at least an additional 400 crewmembers employed in the large pelagic fishery.

Table 5.2.10. Namibian large pelagic fishing fleet 2003 – 2004: Mean characteristics of long-line and pole & line vessels.

Characteristic	Total Fleet	Long-line	Pole & line
Length (m ± Std Dev)	27 ± 12	26 ± 9	36 ± 17
GRT (tons ± SD)	167 ± 146	142 ± 100	308 ± 264
Horsepower (kW ± SD)	540 ± 337	509 ± 301	698 ± 480
Crew (± SD)	20 ± 5	19 ± 5	24 ± 3
Construction Year (± SD)	1976 ± 15	1977 ± 15	1975 ± 16
% Local Flag	33%	36%	14%

Most (85%) of the pelagic long-line vessels operated out of Walvis Bay during the 2003 – 2004 season, whilst all of the pole & line vessels used Luderitz as their primary landing harbour.

5.2.2 Analysis

The Namibian Fisheries Ministry's goals include, Namibianisation of the industry, empowerment of previously disadvantaged individuals, rebuilding stocks, and building the industry. Namibia seems willing to exert its enforcement strength, and appears to respond rationally to pressure from industry participants, as evidenced by its recent closure of the small pelagic trawl industry. Nonetheless the government's stated objectives seem sometimes to conflict with the viability of the industry. The distortions currently in place as a result of state intervention consequently require careful evaluation.

The fundamental contractual relationships between state and industry are sound. The Fisheries Ministry sets TACs for all major species, based on recommendations from fisheries scientists. The TAC is distributed amongst the right holders in the form of quotas. The use of individual quotas ensures that there is no "race to fish" for the TAC. All vessels must obtain a licence to fish in Namibian waters. A secondary aim of quota allocation is to improve companies' efficiency levels, by increasing their information levels and allowing them to plan forward. Fishing rights are granted for periods of 7, 10, 15 and 20 years depending on levels of investment and the level of Namibian ownership, amongst other factors. These rights have not been made freely transferable in order to protect the progress made in the Namibianisation of the sector. Trading is regarded as undesirable, as it limits the ability of new, 'previously disadvantaged' rights holders to compete with pre-existing rights holders.

There are, however, sources of inefficiency in the contract. The ministry charges fees to recover costs of management, and to induce fishers to work towards Namibianisation and conservation. These quota fees are charged regardless of whether or not fish are landed,

and thus are a fixed cost for permit holders. This induces firms to utilise the entire quota so as to spread the costs as widely as possible. It means that when stocks are in poor shape vessels will continue fishing beyond the point where they would otherwise have stopped. This increases revenues for the state, but stresses the resource even further. These fees are structured in such a way so as to encourage the use of Namibian labour, both onshore and offshore, and Namibian vessels. This may interfere with the efficiency of producers, especially if there is a larger cost to processing onshore, or to using Namibian labour, such as less skilled labour, or tighter labour market regulations. Such fee structures unbalance the optimal input mix of producers.

By-catch fees are charged for any species caught which are not the target species. Discarding is prohibited; hence all fish must be landed. These fees are set at rates which discourage the targeting of by-catch species, but still make it profitable to land completely incidental by-catch. This creates the right incentives for producers to fish in a sustainable manner. It is also cheaper to set penalties for by-catch than to set up a complicated quota system for by-catch. This saves a great deal of resources which would be used on much careful log keeping and analysis. The ban on discarding also makes monitoring of catches easier.

Research is funded through the Marine Resources Fund (MRF) which is financed by a small fee charged on all landings. This means bigger producers pay proportionately more for the scientific research done, and small producers are not penalised. Nominal licensing fees are paid for vessels to fish in Namibian waters. Namibian vessels also need a license to fish outside of Namibia's EEZ. This discourages illegal extra-territorial fishing. Combined with 100% monitoring of larger vessels, this enables the state to follow a precautionary approach to fish stock management.

Although there are foreign vessels fishing in Namibian waters, the country has no access agreements for vessels from other states. Foreign interests may apply like Namibian companies for rights to fish, but preference is be given to companies that have higher levels of Namibianisation. Joint ventures between Namibian and foreign companies are welcome.

Compulsory levels of on-shore processing apply, hake being the most prominent example of this policy. 70% (latterly 60%) of the hake TAC is set aside as wetfish quota, which is landed on ice for on-shore processing, and 30% (40%) is allocated to freezer vessels that process their catch at sea. This measure distorts producers' inputs, and constrains returns for those producers who have expended capital on freezer trawlers.

Monitoring in Namibia is very complete. The cost of monitoring has been kept in line with the value of the resource, and this cost is low relative to the value of the annual harvest. Monitoring includes a program of inspection and patrols on land, at sea and by air, to ensure compliance, as well as inspection of landings. Onboard monitors are also present on large vessels who ensure compliance. Vessel marking systems which help monitors to quickly identify illegal fishing in Namibia's EEZ. An information requirement is also laid on permit holders to supply details of entry and exit from Namibia's EEZ, also their CPUE and all landing details. Transhipment is only permitted in Namibian ports. These information requirements may be fairly onerous to producers, but they enhance compliance with quota restrictions. Vessels are also fitted with satellite based vessel monitoring systems. The honesty and security of monitors are twin problems that have to be addressed: *Quis*

custodiet custodes[25]*?* VMS offers one answer, providing a back-up for onboard monitors when they report, as well as a means of monitoring them.

It is important to stress that scientific observers and monitors perform very different functions. Both Namibia and South Africa are increasing the use of trained scientific observers to inform the management of stocks. Unlike monitors, they do not check for illegal activities such as dumping or use of illegal gear.

Although monitoring is supposedly 100%, small vessels may fish without monitoring provided they hold an official exemption letter. Without monitoring, any penalties on by-catch will cease to prevent such problematic activities as discarding of by-catch species and high-grading.

5.2.2.1 Penalties for over- and under-fishing

The system in operation is not draconian and provides some flexibility. It recognises that there is a time-lag involved in reconciling a vessel captain's estimate of the catch with the actual amount landed. Typically a captain estimates each trawl's contents and records these in his log; the actual landed mass, however, is only determined by inspectors at the dock. Both numbers should be recorded and a running total kept. There are, however, lengthy time lags involved in assembling this data; consequently, at the end of the year the captain may not know what is official total catch to date and whether it is under or over his quota allocation. To escape this problem a fisherman or firm has a 10% leeway to over- or under-catch his/its quota. The difference can be rolled over and added/subtracted to/from following year's quota. If the catch is more than 10% over the quota there may be repercussions including cuts in quota. Also the full fee has to be paid even if fish are not landed.

The penalties for over-fishing appear low in Namibia. However, while the maximum spot fine is minimal (<$300), any reported contravention means the vessel has to return to port (or stay there), while the skipper has to appear in court. These measures are clearly costly and the threat of them as well as the possibility that future quota may be threatened, are powerful disincentives to illegal fishing activities. It is worth stressing that, as elsewhere in the world, fishing industry monitors in Namibia are relatively poorly paid. The potential for corruption of monitors and inspectors is a problem in all three countries of the BCLME.

5.2.2.2 Investment and Subsidies[26]

Subsidies typically induce over-capitalisation; they also reduce the incentives for firms to exit from the industry when catches are low and consequently lead to over fishing, and distort trade unfairly. Apart from some fuel rebates, the Namibian government does not provide any subsidies to the fisheries sector. Indeed, the fishing industry pays the fisheries ministry a resource rent in the form of quota levies. Importantly, these are paid in advance and upon acceptance by the right-holder of the quota allocated for a specific fishing season. This means that firms keep fishing in poor seasons beyond the point at which they would stop fishing were the levy paid per ton actually landed! From a sustainability perspective this makes little sense. Over and above the quota levy, right holders are required to pay a levy per ton of fish landed to support research and training. This money is deposited in the Marine Resources Fund whose budget (and its use) is approved by the Ministers of Fisheries and Finance. Research costs of the Directorate of Resource Management are met from the fund. Industry also contributes to the costs of keeping on-board observers.

[25] Who guards the guardians?
[26] Some of the following information is drawn from the FAO website.

The number of whitefish processing plants grew from zero in 1991 to over 20 in 2002. Total capital investment in vessels and shore infrastructure, including new fish processing factories, has exceeded N$2 billion since 1990. Many Namibian fishing companies provide contributions to social development schemes throughout the country. On a continual basis, fishing companies provide money and other forms of assistance for the construction of schools, clinics and other much-needed civic facilities. The contribution to such worthy causes over the past 11 years is in excess of N$33 million as indicated in the table below.

Table 5.2.11: Indicative investments and socio-economic contributions made by rights holders since Independence

Sub-sector	Investments (N$)	Socio-economic contributions (N$)	Total (N$)
Demersal	1,203,153,010	16,472,599	1,219,625,608
Monk	296,165,000	2,066,241	304,631,241
Mid-water	141,700,000	6,264,000	142,164,000
Small Pelagic	262,480,000	6,769,000	269,249,000
Large Pelagic	146,000,000	1,196,000	147,196,000
Linefish	12,023,000	65,000	12,088,000
Crab	14,400,000	N/a	
Rock Lobster	6,395,772	828,862	7,224,634
Total	**2,082,316,782**	**33,661,702**	**2,115,978,484**

(Source: FAO website. Note that a number of right holders in each fishery had yet to provide data, and therefore the above figures are lower bound estimates of investments and social contributions.)

5.2.2.3 Hake

Gear restrictions in place include a mesh size of 110mm and a prohibition of tickler chains (to reduce by-catch of monkfish and sole). Geographic restrictions relate to depth and to the protection of orange roughy areas. Roughy are a high value slow breeding species, which are cheap and easy to fish when they collect in breeding aggregations. The fishery is managed separately; hence hake vessels are kept out of these areas. In normal coastal waters north of Latitude 25° South, only waters deeper than 200m can be fished. South of 25° only waters deeper than 300m can be fished by wetfish vessels and only waters deeper than 400m can be fished by freezer vessels. Since M. Capensis (shallow water hake) is a higher value species than M Paradoxus (which is typically found in waters deeper than 350m), the rule apparently restricts freezer vessels to the less preferred M. Paradoxus, even though the quota allocation process does not differentiate between the two species.

In a further attempt to reduce effort and reduce stress on the stock, a closed season is being introduced: October will be a closed month from 2006 onwards. This is the month when there is most likely to be joint sexual maturity of both females and males. Quota is ordinarily split 30:70 between freezer and wetfish vessels (including long-liners), though this has been adjusted to meet short-term stresses in the industry. Long-line quota is allocated for a spread of species (hake, shark, and tuna). A long-liner can fish for all of these, but has to indicate

which quota it will be using, and hence which fish species it will be targeting, *before* it leaves harbour.

Officially, there is a 3% limit on kingklip by-catch for hake. However in practice this may not be enforced. Anecdotal evidence indicates there is *NO* ceiling on by-catch, though there are by-catch levies. High value by-catches are a major source of income to the hake industry, hence special attempts have been made to prevent fishers from catching high value, low volume, quota controlled, species like monk and roughy. Discarding of by-catch is practiced, but only of totally non-commercial species (like some of the rat-tails).

An operational management procedure is in place in Namibia to guide the setting of the Hake TAC. Other controls are in place for the Hake industry to prevent the catching of juvenile hake, including certain of the gear and area restrictions.

5.2.2.4 Horse Mackerel

This fishery is capital intensive. Where vessels are leased this need not be a problem. Where the vessels are purchased the onus of debt repayment constitutes an incentive to over-fishing. Any permit condition that requires permit holders to invest in the industry is potentially problematic in this regard. To the extent that the requirement can be met by local firms taking out short-term leases on foreign owned vessels, the permit conditions are not problematic. However, they may be where local companies have to go into partnership agreements with foreign enterprises that own their own vessels.

The resource is shared between the horse mackerel mid water trawl fleet (adult horse mackerel) and the pelagic purse seine fleet (juveniles). Area and gear restrictions are in place for the mid water fishery, including the restriction on fishing in any areas in which the proportion of hake by-catch in a single haul exceeds 5% by weight, or the proportion of horse mackerel smaller than 17cm in length for any net landed exceeds 5%, or in which any pilchard by-catch is caught. The last two provisions relate to the need to increase the mean size of mackerel caught, and to protect the pilchard resource in an attempt to aid its recovery.

Similar provisions apply to surface seiners. The purse seine fleet is required to leave an area immediately, if proportion of pilchard by-catch in a single haul landed on deck exceeds 5% (by weight) per haul; to leave an area, or have the area closed, if the proportion of any catch of horse mackerel below 12.5 cm total length exceeds 5% per set by weight. Again while these restrictions are for conservation measures, they may impose costs on horse mackerel or purse seine fishers. However, by helping the small pelagic species recover from their current low levels, these restrictions should benefit the industry over time.

5.2.2.5 Pilchard

Namibia's pilchard stock recently fell sharply and strong measures have been taken to improve stock levels. Environmental factors are to blame for this as well as over- fishing. A zero TAC was set in 2002 (with low TACs of 20 000 tons in 2003 and 25 000 tons 2004 and 2005). This implies a strong position on the part of the state's fisheries management, and a willingness to stick with an unpopular precautionary approach. This should help to instil beliefs in permit holders as to the seriousness with which Namibia's Fisheries Management views its conservation goals. This sort of attitude goes a long way to preventing over fishing and other unsustainable practices. Minimum mesh sizes, fishing seasons, and pilchard by-catch limitations are in place for this fishery.

5.2.2.6 Deep Sea Red Crab

The stock is shared with Angola and Namibia has initiated joint research activities. This indicates that stock size continues to grow slowly. Catches since 1998 have been close to the TAC of 2,000 tonnes set for the fishery.

Management is TAC based with individual quota. Although ostensibly non-tradable, it is effectively saleable: there being three permits in the industry and only two vessels! There are also technical measures in place. These include: Only fishing with traps is allowed, minimum carapace width of 85 mm, No fishing allowed at depths less than 400 metres. Supply will depend largely on the degree to which the stock biomass continues to increase. Closer co-operation with Angola on research and eventually harmonised management arrangements may see the stock growing at a greater rate. There are indications that the Angolan stock is more stressed than that south of the border. If the crabs are a true straddling or fugitive stock, then cooperation and improved monitoring in Angola would benefit the fishery in both countries. The contract governing exploitation of the stock is efficient.

5.2.2.7 Rock Lobster

Management is by TAC and individual quota together with technical restrictions. These include: Size limitation (65 mm carapace length), Closed season 1 May - 31 October, No berried (egg bearing) females to be landed, Two closed areas. For commercial fishing, only ring nets or traps may be used (no minimum mesh size or escape mechanisms are required in the traps). The catch must be graded immediately it is brought on board and small lobsters returned to the sea. Landings must be made at a jetty in Luderitz, for ease of monitoring. For the recreational fishery: free diving, ring nets and hook and line are the only allowable methods. No harvesting is allowed between sun-set and sun-rise.

With these regulations in place the rock lobster stock is showing signs of recovery, but adverse environmental conditions such as reduced oxygen and sulphur emissions, plus the impact of diamond mining may be having adverse impacts on the stock. The TAC set for the fishery has generally increased slowly year on year, from 130 tonnes in 1994 to 400 tonnes in 2002. Annual catches in recent years have been below the TAC, primarily due to rough sea conditions that inhibit the feeding behaviour of lobster and therefore their tendency to enter the traps. Catches taken by recreational fishing are not considered in the TAC. This could place pressure on stocks especially if the recreational fishery grows. Being a local fishery monitoring should be straightforward. Like much of Namibia's fishing industry, however, the rock lobster sector is currently economically marginal. This places pressure on firms, especially if quota fees are based on the nominal quota rather than the landed catch.

5.3 Angola: Rights Allocation Summary[27]

There are three sectors in Angola's fishing industry: large-scale commercial/ industrial, semi-industrial and artisanal. The last mentioned is confined to inshore waters from which the commercial fleets are officially excluded. Commercial vessels are required to have satellite based vessel monitoring systems (VMS); despite this, however, there have been records of artisanal craft being sunk by commercial vessels fishing at night inside the prohibited inshore zone.

[27] The following summary draws on data and material from the FAO's Angola website and from the Vessel and Rights survey which accompanies this report in BCLME project 03/03.

The Angolan government began the attempt to rehabilitate the fishing industry in the 1980's, with the goal of repairing equipment and port and fish processing factory infrastructure. Until recently, Angola's commercial/industrial fishing sector was dominated by foreign fleets with vessels coming in from Russia, Spain, the EU, Japan and Nigeria amongst others. More recently the broad agreements that gave foreign fleets effectively open access to Angolan waters in exchange for a fixed fee have been suspended, although foreign firms are still fishing in these waters, and are entering into joint ventures with locally registered private and state owned companies. Particularly noticeable has been the entry of Chinese enterprises into such joint ventures. The national industrial fleet and associated onshore processing facilities, however, remain in poor condition. This under-capacity of the domestic fleet seems to have been the prompt behind some of the poorly designed historic contracts such as that (now no longer renewed) with the EU.

The following table contains the TAC limits used between 2000 and 2003 in Angola, though it should be noted that harvests by EU vessels and other foreign fleets were effectively controlled by effort rather than catch (no catch limits were set for species other than shrimp).

Table 5.3.1. Angola: Total Allowable Catches (tonnes) 2000 to 2004 (source FAO).

Resource or species group	2000	2001	2002	2003	2004
Deepwater rose shrimp (*P. longirostris*)	1 600	1 500	1 200	1 200	1 200
Striped red shrimp (*Aristeus varidens*)	800	500	500	500	500
Deep-sea crab	2 000	1 800	1 500	1 500	1 200
Sardinellas	85 000	85 000	100 000	110 000	120 000
Horse mackerel	80 000	80 000	60 000	50 000	40 000
Chub mackerel	---	---	---	21 000	21 000
Dentex group (sea breams)	10 000	10 000	12 000	12 800	7 400
Grunts	3 000	3 000	3 000	3 000	2 000
Croakers and groupers	4 200	4 200	4 200	4 200	3 000
Angolan hake	6 000	3 000	3 000	3 000	1 200
Cape hake	6 000	4 000	3 000	3 000	3 000
Big-eye grunter	7 000	7000	7 000	8 000	6 000
Sharks	---	---	---	6 000	8 000
Others	15 000	14 000	14 000	25 000	25 000
Total				**249 200**	**239 500**

5.3.1 Vessels

The sizes of vessels active in Angolan waters and the evolution of catches with various gears between 1988 and 2003 are given in the following table.

Table 5.3.2. Numbers of fishing vessels and catch effort of the fleet licensed in 2003 (Source: http://www.fao.org/fi/fcp/en/AGO/body.htm).

Gear or target stock	National Fleet			Foreign Fleet	Total	Capture average (kg/day)	Fishing days	Capture (t)	
	Semi-industrial	Industrial	Total	Industrial				Per vessel	Year
Shrimp	17	4	21	22	43	650	300	195	8 385
Demersal	16		16	33	49	5	300	1 500	73 500
Pelagic	6		6	11	17	20	300	6 000	102 000
Gillnet	7		7		7	3	240	720	5 040
Long-line	18		18	3	21	3	240	720	15 120
Cerco[28]	18	78	96	8	104	15	240	2 880	299 520
Long-line tuna	1		1	33	34	3	150	450	15 300
Trap	1		1		1	1.800	300	540	540
Transport	3		3	6	9				
Total	**87**	**82**	**169**	**116**	**285**			**12 950**	**519 405**

5.3.3. Evolution of catches (tonnes) by the *national* fleet by sector between 1998 and 2001 (Source: http://www.fao.org/fi/fcp/en/AGO/body.htm).

Gear	1998	1999	2000	2001
Purse seine	55 309	78 170	134 630	129 790
Trawl	29 849	42 844	45 212	43 264
Long-line tuna	835	2 692	1 078	231
Long-line (fishhook)	2 710	6 693	2 542	8 949
Crab trap	692	460	646	836
Shrimp	5 099	940	2 908	2 860
Artisanal fishery	31 131	38 001	45 802	50 420
Total	157 149	169 800	232 510	246 519

5.3.2 Quotas and Effort Restrictions

A sophisticated range of tools is open to the Minister of Fisheries in Angola for the regulation of catches and effort. The Minister currently has in use: gear restrictions, closed areas,

[28] Although "cerco" sometimes describes a form of inlet/estuary fishing using fixed traps or nets, in this case it refers to purse seine trawling.

closed seasons, minimum sizes for fish caught and sold, and catch quotas. Angola's uses inheritable and partially transferable quotas (transfers subject to authorisation from the Minister) and allows fishing quotas to be used as credit collateral, (again subject to the relevant authorisation). Given reasonable stock assessment and pre-season modelling as foundations the various TACs, with reliable monitoring and a suitable set of penalties for contraventions, the existing system could be bio-economically efficient. Despite these tools, however, the technical capacity to manage the resource remains a problem.

It would be in Angola's best interests to put in place sound management structures to encourage the sustainability of commercial fishing and to control the balance between its demands and those of the growing semi-industrial sector. The artisanal sector is important, especially for subsistence needs, but a commercial fishery would be an important source of revenue for the poorer coastal provinces of Southern Angola. Continuous scientific research needs to be done to establish the state of the fish stocks in order to prevent unsustainable exploitation levels. The existing legislation requires vessels to record and submit catch details. The slow pace at which similar data is checked and compiled is currently a constraint on stock assessment and management in Namibia and South Africa; the Angolan data appears slower to emerge and even less reliable. Cooperation between the state and industry, prompted by the allocation of long-term quota, may be a help in this regard.

> "While the governments of the southeast Atlantic region tend to follow scientific recommendations to a large extent, these TAC recommendations focus on the biological status of the stocks, while socio-economic aspects tend to be neglected. Both countries manage their fisheries through top-down state control systems and until recently stakeholders have not been included (at least formally) in the management process. In recent years, however, the industry and other stakeholders have been partly incorporated into the management system. In contrast, in Angola there is little communication between the Ministry and private sector"
>
> [SADC (2002) in Boyer (2003)]

5.3.3 Small Pelagic Fisheries

Although Sardinellas (Sardinella Maderensis and S. Aurita) exist as major stocks in Angola, the straddling stock of concern is Pilchard (Sardinops Sagax) which exists in Southern Angola but only in relatively small numbers. These fish do on occasion shift north of the border, leaving the Namibian industry short of its basic resource. In the past the governments of Angola and Namibia have cooperated to allow Namibian vessels into Southern Angola to fish for Pilchard (and sardinella). The result is that the Northern Benguela pilchard resource is severely depleted on both sides of the border.

5.3.4 Demersal Fisheries

The 2005 register records 48 demersal trawlers. Note, however, that while demersal trawl south of the border is primarily a hake fishery, dentex (d. angoliensis) is also an important fish in Angolan waters. The vessel numbers have fallen recently, 10 vessels leaving the industry in 2003 Despite this and the measures adopted in 2003 to extend the fishing limits, demersal catches have remained poor (as they have in Namibia and South Africa), especially in the industrial sector, leading to such measures as:

- establishing a bottom trawl close season of three months (August to October) from 2004;

- establishing a maximum quota of 500 t for each bottom trawl vessel;
- banning use of demersal bottom trawl for vessels longer than 40 m in the area between 13º and 17ºS;
- preferentially licensing long-line fishing; and
- reducing the allowable by-catch limit to 5% for this fishery.

5.3.5 Deep Sea Red Crab

The closed period for Crab in February and March has been continued, and the areas and depths of fishing are as adopted in 2003. Although quota is limited and TACs have been held down in recent years, anecdotal indicators are that the resource is in poorer condition than it is south of the border. Average sizes are smaller and CPUE lower. One plausible explanation is illegal fishing including loss as by-catch to demersal trawlers.

5.3.6 Permit Conditions

The following analysis relates to the quota regulations set out in 2004.

- The Ministry of Fisheries in Angola seeks to adjust the fleet capacity to match the availability of fisheries stocks, to prevent over capitalisation in the fisheries.
- Certain boats are obligated to have on board a vessel monitoring system (vessels from 18m of length or larger). This is irrespective of whether the boat is for commercial or semi-commercial use.
- Boats that do not obey the previous provision will not have their licences to fish renewed, except for semi-commercial boats where the required period to install a VMS will be determined by the Minister of Fisheries.
- Crab fishing is not permitted for the months of February and March.
- A closed season is imposed for lobster for the months of January, February and March.
- Small pelagic trawl fishing is banned for the current time, thus the closed season is from the 1st of January to the 31st of December;
- Demersal drag fishing for the months of August, September and October is not permitted.
- Certain areas are protected from fishing. These areas differ depending on the type of boat and or fishing.
- No boats may fish within a distance of 6 miles from bays or ports. Semi-commercial trawl boats may not fish within a distance of 4 miles of the coast line, or in waters shallower than 50m. Boats up to 30 m long may fish no closer than 1.5 miles to the coast. Boats longer than 30 m are restricted to fishing further than 3 miles from the coast, and must keep to depths greater than 50m. Deep water trawling done by boats with tonnage less than 300 may not take place within 10 miles of bays and ports, or within 6 miles of normal coast line, and must occur at depths greater than 50m. Boats with tonnages between 300 and 600 tons must remain further than 8 miles from coast line, and fish in depths greater than 50m. Deep water trawlers with tonnages greater than 600 tons must fish in areas further than 10 miles from the coast line and deeper than 50m. Deep Sea Red Crab vessels between Benguela and Namibe must remain 4 miles or more from

the coastline and between Namibe and the Southern Border of Angola must remain 5 miles or more from the coast line, and may not fish in water shallower than 500m.

- The minimum mesh size for trawl fishing is 80mm for midwater trawl fishing, 110m for demersal and 60mm for pelagic species.
- By-catch restrictions: a 5% by-catch limit is allowed for demersal trawl fishing.
- By-catch is however permitted for joint permit holders (for example horse mackerel by-catch in hake trawling, for a hake and horse mackerel permit holder).
- A national program of biological sampling is in effect at ports and landing places to determine the weights and minimum sizes of commercial species.
- Fishing companies are obligated to allow biological sampling to take place upon landing. The amounts required have been defined in a document provisionally approved by the Ministry of Fisheries.
- The Institute of Sea Inquiry will also continue with the program of sampling by means of scientific observers on board commercial boats, in particular those boats fishing for crustaceans, deep sea trawlers and pelagic trawlers. It is not clear if the scientific observer program is 100%, who pays the costs of accommodating the scientific observers, and what powers these observers hold.
- Permit holders are not permitted to trap fish within bays and ports. In the remaining areas where this is temporarily permitted, mesh size of traps is restricted to 30-36mm. Those permitted to do this type of fishing are artisanal fishers, and semi commercial, but not commercial fishing boats.
- The permit holder is required to accumulate information relating to his/her catch, by filling in daily logs of fish catches. This information is required from lobster and shrimp permit holders, commercial and semi-commercial trawlers. Artisanal fishers will also be required to submit details of their catches.
- TAC's are given in the Fisheries Act which are reflected in the tables above. An extra provision is that Horse mackerel captured may not be used for production of fish meal and fish oil.
- The total TAC does not have to be greater than the TAC of the previous year.
- Each demersal trawler is limited to a quota of 500 tons only.
- Certain companies with interests in infrastructure and transformation in Angola will have priority when quotas are allocated.
- The number of demersal trawl boats operating in 2004 may not exceed the number operating in the previous year.
- Foreign contractors or freighted trawl boats which leave may only be replaced by long-liners.
- The number of boats in the crab fisheries does not have to be greater than the number in 2003.
- All catch, including by-catch, must be landed in ports, terminal fishing boats or bridges for the purpose of monitoring and checking the catch amounts, which will be done by agents of the Ministry of Fisheries.
- The area up to 4 nautical miles from the shore is reserved exclusively for artisanal fishing, and certain other areas are restricted specifically for artisanal fishers and their boats.

- Commercial trawlers or semi-commercial boats are not allowed to fish in the area between 13 and 17 degrees South.
- It is illegal to capture, discard or sell or buy those species forbidden according to the weights and minimum sizes established by the Ministry of Fisheries. This criterion does not apply to fish caught for scientific enquiry. Anyone in contravention of this provision will be liable for punishment.
- Demersal and other trawling boats violating the closed seasons and zones will be suspended for a period of 3 months, and will be subject to a fine.
- Other contraventions may result in the automatic suspension of the licence to fish. The suspension is decided on by commissions for the reconciliation of conflicts. Details of permit condition infringers must be supplied to the National Directorate of Fishing.
- Currently midwater trawling is not permitted due to the scarcity of this resource. The Minister of Fisheries has been authorised to establish the conditions of importation of fished horse mackerel free of customs duty, to make up the short fall in supply in Angola.
- Horse mackerel fishers will be given priority in quota allocation to those who have infrastructure interests in Angola, and to local Angolan companies. The TAC for horse mackerel is set at 140 000 tons.
- In general quota allocation will give priority to candidates legally established in Angola, who possess infrastructural assets in Angola, and process their fish using these assets.
- Those who obtain importation quotas must go through the various importation and customs processes and then process the imported fish with companies who have legal permission to process and sell imported fish.
- Minimum sizes are set for horse mackerel caught by permit holders.
- Landing of horse mackerel is only permitted through certain landing areas which are detailed in the Fisheries Act.

5.3.7 Analysis

5.3.7.1 Previous Agreements in Angola

Angola held previous agreements with the EU for EU countries to fish in Angolan waters[29]. These agreements were first signed in 1987 and were renewed every 2 years thereafter till 2004. Catch limits were only set for shrimp fishers in these agreements, thee were no catch limits set for any other species. Even though portions of these fishing rights were not fully utilised, the underlying structure of agreements like those with the EU (and similar ones with Russia) lent themselves to unsustainable harvesting levels, and it believed that large scale exploitation of fish stocks occurred.

An evaluation of the EU contract indicates what can go wrong. A satellite monitoring system was put into place for all EU vessels fishing in Angolan waters, and fishing was banned within 12 miles of the coast line to protect artisanal fishers. Importantly, however, enforcement was weak and there were reportedly regular contraventions of the 12 mile limit. No scientific knowledge of stock levels was used when setting these agreements. Biological rest periods were not set for any of the fished species. While it was possible to monitor the

[29] See Lankester (2002) for a critical comment on the contract.

whereabouts of vessels, no on-board monitors were in place to measure the amounts caught, by-catch levels, and the numbers of undersize fish caught. The agreements set for the period between 2002 and 2004 did not make any provision for the gathering of scientific information relating to stock levels. No catch statistics were required to be submitted by EU vessel owners. The short-term nature of these agreements with EU ship owners did not help to create an atmosphere conducive to sustainable fisheries. Short-term exploitation was the best response of EU fishers, given the short-term and uncertain nature of these rights. The agreements formed with Angola also included a portion of subsidy by EU member states, with smaller ship owner contributions. This gave EU vessels a competitive advantage on costs compared to Angolan vessel owners, and did not encourage the most efficient fishing and production by EU vessels.

Artisanal and semi-commercial fishing are currently being encouraged by the government in Angola. These are problematic sectors for fisheries management. Given the nature of artisanal fishing, it is difficult to monitor the participants, or to collect any useful information on catches, effort, etc. There is also not the infrastructure or resources for such monitoring and data collection. These sectors supply food for the local market and are significant employers. The support offered to them, however, raises potential problems – a large number of participants generally imply pressure will be placed on the state's fisheries managers to raise TACs when times are bad. This is not a function of Angola having a third world economy, such problems are widespread; the collapse of Newfoundland's fishing industry and state subsidies of the Spanish industry when fish stocks fell, are illustrative examples from developed economies. Angola Fisheries Management place no effective catch limits on artisanal fishers and this may result in excess pressure on fish resources.

The conflict between artisanal fishers and industrial fishing is also problematic, despite the presence of VMS's on board industrial vessels. It remains unclear what recourse is available to artisanal fishers when industrial fishing boats trespass into the inshore waters set aside for the artisanal fleet. Angola lacked the infrastructural capabilities to monitor and manage both previous agreements with EU vessel owners, and the behaviour of artisanal fishers. It is not clear that they will be any better able to control the activities and impacts of the commercial fleets under current arrangements.

5.3.7.2 Investment

Subsidies to fishing industries are now generally recognised as sources of future problems. Current Angolan policy on them appears to contain some internal contradictions. The Angolan government makes no special provisions for investors in the industry, ostensibly precluding subsidies. It does not discriminate between foreign and Angolan investors, implying that foreign subsidies fishing firms can enter the industry, especially in joint ventures. No priority however is officially given to foreign investors, although previously agreements with EU member states included subsidies paid by EU states which gave EU vessel owners an edge cost wise over Angolan producers. One aspect worth watching, however, is the potential for distortion through the exceptions to the current investment system. Economic incentives *are* available to encourage utilisation of 'under-exploited' stocks, new technologies and improvements in fisheries related technologies. Elsewhere in the world (anecdotally including Namibia) such provisions have proved problematic – an unexploited and low value fish is cited as a target species, incentives and quota to harvest it are obtained, and the vessels which go out effectively pay for themselves by targeting high value by-catches.

While fishing itself is unsubsidised, under the new "Basic Private Investment Law" (ANIP) of 21 April 2006, the fish processing industry has, however, been given priority as a sector

where investment is encouraged and which qualifies for incentives. Generous long-term tax breaks (10 to 15 year in the provinces of Benguela and Namibe) and other benefits have been offered in an effort to attract both foreign and domestic investors.

Certain procedures must be followed by investors wishing to invest in the Angolan Fisheries. These include the requirement for the submission of a detailed plan showing how Angola will benefit from the investment and how jobs will be created for Angolans. This project plan must be submitted to the Angolan Investment Agency for approval. This does impose an administrative hurdle to the prospective investor, but is not seen in any way as overly restrictive or discouraging to investors.

5.3.7.3 Allocation of Rights

When allocating fishing concession rights, the Angolan Fisheries Act gives preference to Angolans over foreign companies, without prejudice to the international agreements to which Angola is party. Preference is further given to those applicants who can prove they have at their disposal the means to process, transform and distribute the fish in Angola. This suggests that preference will be given to those who land their fish in Angola for processing as opposed to factory trawlers. This clearly implies a disadvantage for foreign companies wishing to catch in Angolan seas, and then either tranship or process the catch onboard before travelling back to their home ports. It also creates incentives for companies to complete the processing of their catches in Angola and thus create employment for locals. Whether these provisions actually create employment for Angolans will depend on the regulatory environment in Angola, and the levels of working infrastructure present in the country. Joint ventures in which local firms provide quota in exchange for foreign capital, and the catch is then divided, may prove a route by which foreign fishing firms make use of the Angolan resource while leaving little of worth behind. Such agreements are already commonplace in the Angolan commercial fishing sector.

As SADC countries, South African and Namibian firms are entitled to some preference in applying for fishing rights in Angolan waters. However this is only true of underutilised stocks, priority being given to Angolans when awarding rights. Under both the SADC Fisheries Protocol and the Law of the Sea Convention, SADC countries and neighbouring, landlocked or geographically disadvantaged countries, get priority in the conclusion of any agreements. Angola may not grant more favourable conditions to foreigners than to Angolans when allocating fishing rights. The permit conditions given in the Fisheries Act of 2004 do act to protect Angolan interests, especially those of Angolan permit holders, Angolan artisanal fishers, and Angolan processing companies.

Some measures have been put into place to protect fish stocks, and the rights of artisanal fishers. These include closed seasons, protected areas, and the installation of VMSs. The key issue is whether or not Angola has the capacity to enforce these measures. A secondary concern is the lack of scientific monitoring and information gathering. As has been shown, the legislation for data collection is in place, but the practice is problematic. One reason is lack of staff, another is the sizes of the artisanal and semi-industrial sectors (whose catches are effectively unregistered). It is not clear how effective management of fish stocks is in Angola, and what information this management is based on. Due to a previous lack of compliance with fishing restrictions, certain fisheries, such as the small pelagic trawl fishery, have suffered from severe stock level collapse,. Establishing a clear management regime and, more importantly, installing effective compliance enforcement should be of the utmost priority to the Angolan Fisheries Ministry. The Angolan Ministry of Fisheries appears to hold strong views on non-compliance, but they have to be perceived as demonstrably willing to take strong action to protect fish stocks. A rational rent seeker is only restricted by the

'expected value' of penalties for non-compliance with regulations (i.e. the fine multiplied by the probability of being caught). Rather than making the penalties draconian and driving non-compliant firms into bankruptcy, it is rational to increase the probability of a vessel being caught when in contravention.

6. OTHER CONTRACTS IN THE FISHERIES

6.1 Contracts between Rights-holders and Crew in the Fisheries

"Principle/Agent" problems are a common feature of western economies. Amongst these are the problems faced by employers who hire workers, but cannot monitor them every hour of the day. How does an employer set up a contract that makes the employee monitor his or her own behaviour? The most common contract that achieves this is one that pays "piece work" wages i.e. Instead of a fixed wage unconnected to the amount of work done, the worker is paid according to the number of units of output completed satisfactorily. In Southern Africa such contracts are widely frowned upon, indeed, in their pure form they are forbidden in South African labour law. Despite this, they are a basic and popular feature of the contracts between boat owners and their crews!

The crews of fishing boats, from the skipper downward, can influence the amount of fish caught, the mean size of the fish and the species composition, including the proportion of high value by-catch. The skill of the captain and the efficiency of the crew provide one element to this influential power, and most fishing companies remunerate their employees accordingly. A secondary issue is the vessel captain's willingness to contravene permit conditions, and the crew's willingness to turn a blind eye to these contraventions. Whether or not boats avoid designated 'no-fishing' areas, the gear they use to catch fish, and their willingness to dump and high-grade catch, can all influence the value of a vessel's annual take. The contracts between boat owners/rights holders and crew can influence the behaviour of the crew regarding undesirable and illegal fishing practices. Pure performance related contracts offer crews an incentive to over fish, especially where the crews themselves do not bear the consequences of being caught with excess or illegal fish on board.

Both fishing companies and crews in the BCLME region favour the standard international labour contracts that link pay to performance. Such contracts, ironically, shift much of the burden of poor seasons off the shoulders of the fishing companies and onto those of the fishermen themselves. Fishermen, it seems, are inherently both optimistic and competitive.

The ideal contract would have to align the incentives of the fishing crew with those of the rights-holders and of the state. Rights-holders would like to maximize the value of their quota and minimize the cost of achieving it. They would also like to maximize the value of legitimate by-catch. The resource managers' objective is to ensure the sustainability of the stock and to keep up the overall catch per unit effort. From the crews' perspectives some of these objectives may conflict. The resource managers represent the interests of the industry as a whole, while the firm and its employees are the individuals whose personal interests appear at odds with those of the industry.

In the absence of widespread onboard compliance monitoring and enforcement, contracts which reward a skipper only for larger fish will encourage high-grading. Contracts which do not place a value on by-catch while the total tonnage landed is constrained will encourage fishermen to discard fish. Both practices would not only influence the actual mortality of fish, but would also distort record keeping and adversely affect the stock assessment process. An efficient contract should reward proportionately both by-catch and targeted species, and small and large fish, with a limited premium payable only on mature fish *of the officially targeted species*. Such contracts would prompt skippers to focus on catching the largest fish of the targeted species, targeting neither juvenile fish nor by-catch species, but nonetheless bringing in any that they catch. The incentive to discard by-catch and juvenile fish falls as the financial rewards for landing them are increased.

The attitudes of rights-holders to sustainable fishing practice and economic efficiency depend on the regulatory regime in place. Companies may expend unnecessary resources in circumventing regulations intended to preserve the resource. Thus, one suggestion in the region has been that fishing rights be tied to individual vessels, the quota allocated being based on the number of crew aboard. The aim would be to maximize employment generated by a given TAC. The consequence, however, would be a reduction of profits, and a shift away from the employment of *fishermen* and towards the employment of wholly unskilled supernumeries, taken on board to make up numbers. In all cases, companies with only a short-term view to the resource will be less willing to pay for monitoring, or to abide by-catch limits, and are likely to contract with their crews so as to maximize catch revenues without regard for sustainability.

Can contracts offer firms and the industry a double dividend? Desire for worker empowerment, Black Economic Empowerment, Namibianisation and the preference for allocation of quota to Angolans, are realities of BCLME fisheries. Skippers and crews who work only on performance bonuses have little incentive in their contracts to abide by good fishing practice: they own no share in the resource they are exploiting. Contracts which rewarded skippers and crews with long-term rewards (such as future share options) rather than immediate cash payments might align their interests with those of the company and those of the industry. Such contracts would also shift control of the resource to those connected with it without sacrificing efficiency and without the risk of that political rent-seeking present when quota is redistributed from pre-existing firms to 'new' entrants.

6.2 Contracts between Fishery Management and Monitors

The efficiency and honesty of Fishery Control Officers and monitors is key to the outcomes of any fishery management policy. They perform a difficult but important task and need both adequate recompense for their efforts and contracts that create appropriate incentives. It is the fishery control officers who in reality ensure that unsustainable fishing does not take place and that quotas, closed seasons, by-catch restrictions etc are adhered to. They also monitor catches, landings, processing and transshipment, providing the data needed by stock managers. The possible rewards to over-exploitation of high value species may be substantial in the short-term, and recent cases in South Africa have involved bribery of Fishery Control Officers. The control officers' pay and terms of employment may well be an issue in achieving long run sustainability in the industry.

The risk of corruption can be mitigated by the terms and conditions of employment enjoyed by fisheries control officers. Thus, their contracts should include a basic remuneration, plus bonuses for infractions that they manage to contain or stop, and for good record keeping. They should also be shifted regularly. Onboard monitors should also be regularly switched across vessels owned by different companies. Such movements are disruptive, but the costs can be minimised if standard systems are in place.

Scientific observer programmes and fisheries monitoring systems serve different purposes. The former collect scientific data about catch composition, location etc specifically to aid in stock management. The latter enforce regulations and maintain the basic record keeping needed for a controlled fishery to operate sustainably. The two activities should not be confused or conflated. Scientific observers can only work with the cooperation of the captain and crew of a vessel, while the onboard and quayside control officers necessarily have to maintain some distance.

7. POLICY CONSEQUENCES

In the theoretical discussion of contracts in the fishing industry it was argued that *contracts that are well specified and tradable should result in economic efficiency provided that there is adequate monitoring and that suitable penalties are in place*. To what extent do such contracts and such systems of control exist the BCLME countries?

First, at a system wide level, there is no inter-country trading of rights between Angola, Namibia and South Africa. While Angola has allowed foreigners (historically the EU, currently Spain in shrimps, Japan in crabs and a number of states in joint ventures with local firms) to fish her waters, both Namibia and South Africa have allocated their fishing rights to local operators. Latterly Angola too has been (incompletely) moving in this direction with the non-renewal of agreements with the EU and Russia. The disappearance of foreign participants, and their replacement by local firms (especially where these have political lobbying power and engage in rent seeking activities), will reduce flexibility and make it more difficult to reallocate capacity within the BCLME.

Economic efficiency at an ecosystem level implies the harvesting of fugitive stocks when their value is highest, and at the economically optimal rate, irrespective of the territorial waters within which they are found. One aspect of this is the scientific question: are there significant fugitive stocks that shift across national borders in the BCLME? Certainly some shifts occur, but evidence to date suggests that these *generally* involve relative small proportions of the total populations involved. Rather than having vessels from one country pursue fish into the waters of another, the firms involved could be registered and have vessels in both countries. Although rights are not traded across countries in the BCLME, certain companies do have interests in more than one country. Theoretically this could allow for some flexibility in the deployment of fishing capacity across regions, and increase efficiency. What appears to have happened, however, has been a disinvestment of South African companies from Namibia in recent years, with capital being relocated both domestically and abroad (including South America). Both South African and Namibian firms have investigated Angola, but to date cross border investment in the Angolan fishing industry has not been significant.

Namibia and South Africa have not auctioned their quotas. South African quotas are awarded according to a number of criteria, only one of which is fish catching ability. Since quota has been shifted from existing operators to new entrants, this has created an incentive for the industry to overcapitalise. South African quotas also penalise fishers who are unable to catch their allocated quota. Although this is meant to eliminate the problem of 'paper quota', it further induces overcapitalisation and consequently increases the incentive to over-fish.

In Namibia fish-catching ability is similarly important in allocating rights, though the "Namibianisation" policy has allowed significant rent seeking by tying rights allocation to joint ventures between existing firms and new entrants (who had received quota). This resulted in elaborate and costly negotiations where companies with capacity try to outbid each other to enter into agreements with rights-holders. It also meant that companies had no security of tenure in the industry, and consequently no incentive to fish the resource with a long-term outlook. Unsurprisingly, the arrangement has been highly unstable, and the Minister now links rights-holders with companies and 'demands' that they reach an agreement. Rent seeking, however, remains a feature of the industry, paper quota is still a problem, and the economic status of the industry is parlous.

The Angolan rights allocation process is in a state of transition. There is a substantial artisanal sector that appears to have no formal rights. Prior to 2004 Angola signed fishing agreements with the EU. These agreements were for a limited period only, no monitoring occurred, and the contracts involved the exchange of a fixed sum of money. There were thus strong incentives for EU vessels, anticipating non-renewal of contracts, to mine the stock. In addition, there were strong incentives to high-grade given the distance between their home ports and the fishing grounds.[30]

Both Namibia and South Africa have lengthened the lives of fishing rights in an effort to encourage a longer-term focus on the part of the harvesters. This should increase economic efficiency and allow companies to make the necessary long-term capital investments. It is not clear, however, that these longer-term rights will increase the responsibility of the fisher in the later years of the contracts since the rights are finite. Rights-holders who fear they will lose their rights, or that their rights will not be renewed, will have a growing future incentive to over-fish. Depending on the lengths of time that affected species take to regenerate, we may see fishing companies adopting different strategies at different points in the life of a fishing right. In the beginning companies may adopt a fairly conservative approach, but switch to overexploitation at the end of the right's life. A similar effect might be observed if 'grandfathering' is expected – i.e. if historic catches expected to be the basis for future quota shares there may be a race to harvest in the latter years of existing quota rights.

7.1 South Africa

The South African authorities in their general draft document on fisheries policies released in March 2005 paid little attention to the economic incentives driving fisher behaviour. The document committed management to maximum sustainable yield as a policy goal (and eventually an ecosystem-based management system) [31], and described itself as explicitly opposed to monopolies in the fishing industry[32].

The draft document in fact defines 'monopoly' rather loosely, and appears to understand it as 'natural monopoly', i.e. the ability to out-compete new entrants in terms of efficiency. In other words, the document explicitly sees that broadened access should take precedence over economic efficiency. It has been shown earlier that fish is a globally traded product and that substitutes exist. This being the case, if a local monopoly or oligopoly is the most efficient way to exploit a fishery then, when competing in a global market; a move away from the pre-existing oligopoly structures will entail economic inefficiency.

There are costs to broadening access that go beyond forgone economies of scale. The most obvious is an increase in monitoring costs. The stability of a solution decreases as the number of participants rises. In other words, the cost of controlling the industry goes up as the number of firms rises since it becomes increasingly difficult to induce them to act in accordance with management goals.[33] At the limit this results in the 'tragedy of the commons'; economic overexploitation of the resource as each participant over-fishes out of fear that their rivals will also do so. It can also create an industrial structure where regulations are not upheld. Therefore the desire to broaden access to the fishery can conflict not only with economic efficiency, but also with biological sustainability. Broadened access to fisheries may also result in increased pressure on decision-making authorities to increase TACs or otherwise change the effort restrictions in place.

[30] See Daw *et al* (2005) for a discussion of the failure of the EU Common Fisheries Policy.
[31] Department of Environmental Affairs and Tourism, 2005 "Draft General Policy on the Allocation and Management of Long-term Commercial Fishing Rights: 2005", p. 7.
[32] Department of Environmental Affairs and Tourism, 2005 "Draft General Policy on the Allocation and Management of Long-term Commercial Fishing Rights: 2005", p. 75.
[33] See Hutton et al who explores the adverse implications for co-management in the deep-sea hake sector.

The South African government has not auctioned rights, although it attempts to recoup some of the costs of managing the commercially exploited species. But the rights are not understood as 'property rights', and are not technically tradable. There is thus no guarantee that the rights will accrue to the most efficient producer. It is also far from clear that the government initially wished to assign the rights to the most efficient producers.

Smaller players can have an incentive to target by-catch in order to remain economically viable. Certain smaller hake companies appear to have regularly targeted by-catch species when hake seemed scarce. Larger companies might have an incentive to high-grade, particularly if their processing factory operates more efficiently with certain sizes of fish. This problem is probably most severe in the long-lining sector which has the least flexibility when it comes to fish size. The incentive to cheat on quota is also higher for firms that are economically marginal, such as a number of new entrants in the pelagic industry. Here there appears to be circumstantial and anecdotal evidence of widespread over-fishing. Existing players who fear their quota will not be renewed also have an incentive to over-fish.

Measures to minimise ecosystem damage, though rational at an industry wide level in the long run, make little private private economic sense to fishermen and firms, and it is unclear how they will be enforced. Companies have little incentive to report their damage to the ecosystem accurately, and it is likely that such information will be unreliable.

Like the Namibian system, the South African resource management approach actively penalises participants who fail to land their quota. Although intended to eliminate paper quota holders, it could simply result in destructive and inefficient fishing by participants attempting to simply avoid penalties. It seems much more sensible to spend more time and effort trying to spot potential ‘paper’ or ‘cardboard’ quota holders in the initial allocation process. Thereafter quota-holders should be free to catch their quota or not. Full transferability of quota is problematic because of the state policy of Black Economic Empowerment. Non-transferability would mean that a BEE fisherman who was battling financially would be unable to sell his rights and escape debt. Although currently frowned on, some ‘short-term leasing’ of quota does occur – clearly economic efficiency requires that rights-holders be allowed to transfer their quota to more efficient producers if the economic circumstances dictate.

7.2 Angola

Poor infrastructure conditions (road and rail links, unreliable electricity) severely constrain the ability of Angolan companies to add value and employment in the southern coastal provinces of Namibe and Benguela. Although these constraints are being addressed, they currently appear to consign land-based processors to a low-value product that cannot target lucrative export markets. Capital-intensive freezer vessels (like those of the EU or Japanese crab fishing boats) are more efficient, but obviously impose significant monitoring difficulties and information requirements.

The decision to encourage joint ventures in which vessels and plant come in from abroad in exchange for a fixed share of catch offers a short-term solution to undercapitalisation, but needs careful evaluation. It has the potential to prove as problematic as the contracts with the EU and Russia, without the benefits of fish stock assessment surveys etc. that the latter provided.

7.3 Namibia

The Namibian government 'medium term' rights strongly favour Namibian citizens. Rights holders do not appear to need an active interest in the fishery, and the Minister intervenes to team up existing fish producers with rights holders. The costs of managing the fishery are levied on the harvesters of the resource and not the rights holder. A number of quota allocations appear to be economically sub-optimal, particularly in the hake fishery. This necessitates consolidation in the industry, and increases the pressure of marginal players to cheat on quota.

Namibia has 100% monitoring on its vessels, and there are high penalties for exceeding by-catch quotas.

The Namibian government has encouraged land-base processing, particularly in the hake sector, where it has awarded wet and freezer-based rights separately in a 70:30 ratio. Economically Freezer-based trawling appears to have an edge over wetfish trawling (freezer vessel hake quota trades at a premium over wetfish quota on the 'black' market) and this has increased the vulnerability of the industry to an economically difficult environment such as that in 2005/6.

The Namibian solution to increase employment has lead to a low CPUE equilibrium that requires full time monitoring to prevent quota cheating, or by-catch targeting. In the current difficult environment (strong exchange rate, high fuel prices) it appears to impose substantial costs on the industry.

8. CONCLUSIONS

Rent-seeking behaviour is a feature of real world fisheries. Confronted by control measures fishermen try to turn these to their own advantage. Such rent seeking remains a real concern in all three countries. The problem begins with the quota allocation process: South Africa has attempted to make the rights-allocation process transparent, but this has imposed additional costs on small operators trying to complete application forms, and the current dissatisfaction amongst small fishers and their belief that there has been successful rent seeking in the allocation process, point to the problems. There are strong incentives to misrepresent information, and large costs attach to verifying it.

All three countries have the contractual basics in place to be able to achieve bio-economic efficiency. Despite this none shows any sign of achieving it. Stocks have to be allowed to recover – in the circumstances the existing quota based approach could be augmented by a system of rotating closed areas to allow resident demersal species a chance to recover. In the long-term good monitoring and appropriate penalties will have to be recognised as prerequisites for bio-economic efficiency.

A self-policing quota contract is a holy grail for fisheries managers. Such things have worked in small scale fisheries where fishermen can monitor each other. However, in an industry characterised by large vessels that do not move in and out of port daily, monitoring of catch and effort is a key. For resident species VMS may ultimately offer a solution; long-term fishing rights can be allocated to a single firm for a given area of the sea. Other vessels being prevented from travelling in the area at trawling speed, the firm would have an incentive to manage the resource optimally as a geographic monopolist. This approach, however, offers no solution for migratory species.

A problem is that bio-economic efficiency is not, necessarily the primary aim of resource managers. Angola's favouring of domestic producers over more efficient foreign competitors, Namibia's emphasis on wet-based processing to generate more employment, and South Africa's anti-monopoly bias, all point towards goals other than efficiency that are driving fisheries management.

These policies create perverse incentives, and are likely to have unintended consequences. Angola's effort to develop the local industry is likely to subsidise access to the fisheries and create over-capacity problems in the future, particularly given the limited opportunities elsewhere in the economy. Namibian vessels have been forced to adopt less efficient harvesting techniques, and consequently in adverse economic conditions are unable to attempt to catch their quota, despite strong penalties if they do not do so. Their ability to access bridging finance has been diminished and the survival of some erstwhile viable firms now seems threatened. South Africa's attempt to broaden access has fragmented the catching side of the industry, and increased monitoring costs. There is widespread concern of illegal fishing, especially in the pelagic and rock lobster industries. More tellingly, broadened access exacerbates the 'prisoner dilemma' problem, and moves the solution away from efficiency and sustainability. This is most obvious in the hake industry where a stable competitive oligopoly has deliberately been undermined.

9. GLOSSARY

BCLME	Benguela Current Large Marine Eco-System Program
CPUE	Catch per unit effort
Depensation	The level below which a stock or population cannot sustain itself even in the absence of harvest.
Discarding	Fish are discarded for being over quota, under size, in berry, the wrong species.
EEZ	Exclusive Economic Zone
High-grading	Taking fish out of the hold and discarding them, and replacing them with more valuable fish.
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICSEAF	International Commission for the South-East Atlantic Fisheries
IOTC	Indian Ocean Tuna Commission
IUU	Illegal, unreported and unregulated (fishing)
MCM	Marine and Coastal Management (SA)
MEY	Maximum economic yield
MSY	Maximum sustainable yield (MSY)
OMP	Operational Management Procedure
PMCL	Precautionary Maximum Catch Limit
RFMO	Regional fisheries management organisations
SME	Small and Medium sized Enterprises
TAC	Total Allowable Catch

10. REFERENCES

Barrett, S. 1994. "Self Enforcing International Environmental Agreements". *Oxford Economic Papers* 46, 1994, 878-894.

Boyce, J. 2004. "Instrumental Choice in a Fishery" *Journal of Environmental Economics and Management*. Vol. 47, pp. 183-206.

Boyer, D. and Boyer, H. (2003) The large volume small pelagic fisheries of the South East Atlantic: Angola, Namibia and South Africa *FAO Discussion papers no 700*. (Proceedings of workshop on international fisheries instruments) http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/007/y5242e/y5242e0b.htm

Carroll, T., D. Ciscil & R. Chisholm, 1979. "The Market as Commons: An Unconventional View of Property Rights" *Journal of Economic Issues* Vol. 13, No. 2.

Charles, A, T. Chapter 6. *Use Rights and Responsible Fisheries: Limiting Access and Harvesting through Rights-based management*. Saint Mary's University, Nova Scotia, Canada. 2002.

Clark, C. W. 1973. The Economics of Overexploitation. *Science, New Science*, Vol. 181, No. 4100, pp. 630-634.

Coase, R. 1937. "The Nature of the Firm" *Economica*, Vol. 4, No. 16, pp. 386-405.

Daw, T. & T. Gray, 2005. "Fisheries Science and Sustainability in International Policy: a Study of Failure in the European Union's Common Fisheries Policy" *Marine Policy* Vol. 29 pp. 189-197.

Degnbol, P. 2003. "Science and the User Perspective: The gap co-management must address" in Wilson, D., J. Nielsen & P. Degnbol (eds.), *The Fisheries Co-Management Experience*, Kluver Academic Publishers: Netherlands.

Demsetz, H. 1967. "Toward a Theory of Property Rights" *American Economic Review*, Vol. 57, pp. 347-373.

Eisenack, K., Krapp, J. & H. Welsch. 2004. A Qualitative Dynamic Modelling Approach for Investigation of Capital Accumulation in Atomistic Open-Access Fishery. *Journal of Economics and Control* (accepted for publication)

Elago, P.N. 2004. Duration of Fishing Rights and Investment: *An Empirical Study of Investment in Namibian Fisheries*. Directorate of Policy, Planning and Economics, Ministry of Fisheries and Marine Resources, Windhoek.

Feeny, D., Hanna S. & A. McEvoy, 1996. "Questioning the Assumptions of the 'Tragedy of the Commons' Model of Fisheries" *Land Economics*, Vol. 72, No. 2, pp. 187-205.

Furubotn, E. & S. Pejovich, 1972. "Property Rights and Economic Theory: A Survey of the Recent Literature" *Journal of Economic Literature* Vol. 10. No 4, pp. 1137-1162.

Godwin, R. & W. Shepard, 1979. "Forcing Squares, Triangles and Ellipses into a Circular Paradigm: The Use of the Commons Dilemma in Examining the Allocation of Common Resources" *The Western Political Quarterly* Vol. 32, No. 3, pp. 265-277.

Gordon, H. 1954. "The Economic Theory of a Common Property Resource: The Fishery" *Journal of Political Economy* Vol. 62. pp. 124-42.

Hardin, G. 1968. "The Tragedy of the Commons"

Hutton, J., Nielsen, J. & M. Mayekiso. Undated. Government-Industry Co-management Arrangements Within the South African Deep-Sea Hake Fishery

Lankester, Kees. 2002. The EU-Angola Fisheries Agreement and Fisheries in Angola. www.iisd.ca/publications_resources/ water_wetlands_coasts.htm

Lindebo, Erik. Application *of Individual Quota Management to Danish Fisheries* Danish Research Institute of Food Economics FOI January 2001

Mather, D.J. 2004. Fishing Rights, Redistribution and Policy: the South African Commercial TAC Fisheries. Unpublished PhD. Rhodes University.

Meade, J. 1952. "External Economies and Diseconomies in a Competitive Situation" *The Economic Journal* Vol. 62, No. 245, pp.54-67.

Milgrom, P. & J. Roberts, 1992. *Economics, Organisation and Management*. Prentice-Hall International: New Jersey.

Ministry of Fisheries and Marine Resources, 1993. Policy Statement on the Granting of Rights of Exploitation to Utilize Marine Resources and on the Allocation of Fishing Quotas. *Republic of Namibia*.

Munroe, G., Van Houtte, A., & R. Willmann, 2004. The Conservation and Management of Shared Fish Stocks: Legal and Economic Aspects. *FAO Technical Paper. No. 465.* Rome: FAO.

Myburgh, Emile from Emile Myburgh Attorneys. Consultation and Advice.

Pascal, S. & S. Mardle. 1999. Optimal Fleet Size in the English Channel: a Multi-Objective Programming Approach. Paper presented at the Resource Modelling Association Conference, Halifax 23-35 June.

Sauer, W.H.H., Hecht. T., Britz, P.J., & Mather, D. *An Economic and Sectoral Study of the South African Fishing Industry*. Volumes 1 & 2. Report prepared for Marine and Coastal Management by Rhodes University (2003). Available online at www.envirofishafrica.co.za/projects/ess.html.

Scott, 1956,

Shotten, R. (ed.), 2001. Case Studies on the Allocation of Transferable Quota Rights in Fisheries. *FAO Technical Paper. No. 411*. Rome, FAO.

Shrank, W. E. "The Newfoundland Fishery: Past present and future." Department of Economics, Memorial University. 1997.

Sowman, M. 2003, Hauck, M., Clark, B., Russell, E., Harris, J. M., Venter, A., Beaumont, J. and Z. Maseko. 2002. Perceptions of subsistence and informal fishers in South Africa regarding the management of living marine resources. S. Afr. J. mar. Sci. 24: 463-474.

Stoneham, G., Lansdell, N., Cole, A. & L. Strappazzon, 2005, "Reforming Resource Rent Policy: An Information Economics Perspective" *Marine Policy* Vol. 29, pp. 331-338

Thorpe, A., Reid, C., Van Anrooy, R., & C. Brugere, 2005, "When Fisheries Policy Influence National Policy-Making: An Analysis of the National Development Strategies of Major Fish-Producing Countries in the Developing World" *Marine Policy* Vol. 29, pp. 211-222.

Turvey, R. 1964. "Optimization and Suboptimization in Fishery Regulation" *The American Economic Review*, Vol. 54, No. 2, Part 1, pp. 64-76.

Van der Berg, T. 2000. "Neo-classical economics, institutional economics and improved fisheries management" *Marine Policy* Vol. 24, pp. 45-51.

Wickham Eric. *Dead Fish and Fat Cats: A No-Nonsense Journey Through Our Dysfunctional Fishing Industry*: 2002 Granville Island Publishers.

Websites referenced:

- FAO: http://www.fao.org/fi/fcp/en/AGO/body.htm
- http://reference.allrefer.com/country-guide-study/angola/angola112.html
- Feike: www.feike.co.za
- Department of Environment and Tourism: http://www.deat.gov.za/

11. APPENDIX: WORLD EXPERIENCE OF RIGHTS ALLOCATIONS PROCESSES, A LITERATURE REVIEW

Some of the most important questions to be considered in fisheries management include:

1. Who has the property right to the resource, and how is it allocated?
2. How is the right to the resource priced?
3. Are rights allocated to vessel owners, or to individuals who then trade with vessel owners after allocation?
4. Are the rights to the resource truly rights, in that they are tradable, secure, exclusive, and durable?
5. Are rights allocated for short or long-term periods?
6. How does harvesting of one particular species affect other species in the food chain?
7. Who pays for monitoring, and scientific research on the stocks?
8. How are migratory and trans-boundary stocks managed?

The following summary is not complete, but picks on individual fisheries around the world to examine how differing management styles have enabled fisheries to meet their goals. Much of the information in the following section is taken from Lindebo, (2001), and Wickham (2002).

Summary

In many of the following case studies, the introduction of ITQs has seen in increase in the bio mass of the stocks under management, an increase in the price of quota, and higher concentration and better enforcement in these fisheries. Those fisheries where rights are not fully secure have seen competition for resources, and over fishing. Industries do not tend to restructure unless quotas are nearly fully tradable, as there is no good incentive to do so. Thus an industry may remain over capitalized needlessly. In general efficiency has improved in those industries using ITQs, and the ability of fishers to supply all through the year has better meet the needs of the market. Management costs have been seen to be recoverable, as a percentage of catch values. Those industries with high levels of subsidies have maintained inefficient levels of employment, and have not succeeding in producing a more concentrated and efficient industry.

Alaska

We analyse Alaska separately from the US, as they are geographically separate. The Alaskan halibut and sablefish fisheries impose a license fee scheme similar to Iceland. Individual fishing quotas are used in Alaska. The initial allocation was free, and was based on catch history for the best 5 years between 1984-90, based on regulatory areas and vessel categories. These rights are permanent but may be revoked for non-compliance. They may be transferred between initial recipients and qualified crew. There are transfer limits between vessel size classes. There are minimum holding restrictions in place. Quota prices have risen much higher than the price of these species per pound in the US. Reductions in quota holders have occurred, and been on the scale of between 18 and 24%.

There is a nominal license fee and 3% ex vessel harvest value. Conservation goals have been met in these fisheries. Improved safety levels have been observed. Thanks to the lengthening of fishing seasons in Alaska, quality and price of landings have increased. Rights holders can now better match supply with demand during the year, thanks to the use of ITQs.

Alaska has dealt successfully with the problem of by-catch in the halibut by offering a price for all sizes of fish, and thus there is no incentive to high grade. By-catch of ground fish in the sablefish industry reduced from 24% to less than 10%, and the discarding of juvenile fish is less than 2%. Here successfully pricing the different types of fish created the right incentives for the industry players.

Enforcement occurs in the form of regulations which have established a monitoring and enforcement regime. Fish sales are registered, and there are penalties for non compliance which include forfeiture of quota.

Australia

Australia's main fishery is the south blue fin tuna, which is caught by long-line, pole and line techniques. The system in place to manage the fishery is that of ITQs, with an initial allocation which is free. Allocation is based 75% on catch history, and 25% on vessel investment levels. Ownership of the quota is in the hands of vessel owners, and these rights are permanent. Rights are fully transferable and divisible amongst Australian operators. There are no holding restrictions. Quota prices have increased as quota leasing to Japanese companies has increased. Due to shortage of stocks, 90% of quota is concentrated in southern Australia, and 5% of quota holders hold 62% of quota.

Fishers pay a levy which pays about 90% of management costs. There have been some problems with high-grading, but overall stocks are getting back to conservation goal levels. The fleet size has shrunken with the introduction of ITQs, and the industry is increasingly more cost efficient. The value of the industry has increased greatly, despite smaller catches. Enforcement in this fishery is difficult, due to trans-boundary fishing, and enforcement is costly, but most of these costs are recovered in full.

Canada

The Herring fishery in Canada is managed by a system of ITQs, and the method used to fish is mainly purse-seining. The initial allocation of these quotas is free, and quotas were allocated equally to vessels that had fished during one year during 1980-83. These rights were initially given for 10 years, and were subsequently continued. Quotas are fully transferable if the quota is not divided and the sellers permanently leave the fishery. Fishers may not sell quota to processors. This prevents vertical integration in the industry. Pooling of quota between vessels is allowed, but no leasing. A maximum holding of 4% of quota is allowed, which has limited fleet restructuring and concentration.

There is no documentation on the changes in quota prices in the herring industry. There is no cost recovery in this fishery. Enforcement has increased which has mitigated misreporting problems, however enforcement is still difficult. Stocks have improved since the introduction of ITQs; however the fleet size and employment have both decreased. There has been improved vertical integration which has increased efficiency, and an extended fishing season has improved safety.

The ground fish industry has a free initial allocation of quotas, which was based on catch history. These quotas were 5 years and have been extended. Transfers are restricted to

exchanges in a particular year, and there are no permanent transfers. Limits on transferability have meant there is no need for holding restrictions. The overall fishery has declined, which has resulted in fairly stable quota prices. Concentration has increased in the industry. Costs are recovered by charging a percentage of catch value annually. Enforcement has increased which has helped to mitigate problems of high-grading and by-catch. Enforcement is fairly easy to do due to the smaller fleet. Stock levels have been declining since before the introduction of ITQs, but catching has been more in line with market demand.

The Canadian salmon industry has found its stocks collapsed, due partly to inadequate controls on fishing, and the use of effort controls as opposed to quotas or any other restriction on catch amounts. Attempts have been made to concentrate on the production of farmed salmon rather than wild salmon; however farmed salmon production generates some problems. Farmed salmon spread diseases to native species which they themselves are immune to, they escape and establish themselves in habitats belonging to the wild salmon, thus making it even harder for the wild salmon to regenerate, they contain lower levels of healthy omega 3 vitamins, and protection of their pens impacts many other species (Wickham, p85). Farmed salmon are also fed high quantities of antibiotics, and their pens emit pollution into the rivers or seas in which they are kept. They are also dependent on the supply of fish food which forms a large part of the overall cost structure of farmed salmon production.

The Canadian Sablefish industry in contrast, worked together to set quotas, set aside money to pay for scientific research, and allocated resources to pay for strict monitoring. Thanks to their insider information on the sablefish industry, the industry players were able to construct good systems of monitoring and quota allocation, both of which kept over fishing to a minimum. When the total allowable catch was determined by the industry itself, it was set at levels which were ecologically sustainable. The industry participants felt a sense of ownership to the resource, and worked to ensure the resource was available for more years to come. Industry participants also worked to ensure that their fishing efforts did not impact on juvenile fish, and on egg bearing females (Wickham, p159).

Denmark

The Danish Fisheries are characterized by over capitalization in the form of a too large fishing fleet, and fish resources that are under pressure of exploitation (Lindebo, 2001). The management system in place does not reward more efficient producers, and there is no incentive in place for new younger fishermen to enter the industry, or for vessel owners to modernize or invest in their boats.

Denmark's fisheries management recently introduced a scheme to attempt to recover administration costs from quota holders. Denmark has a relatively small number of vessels and ports, and an adequate enforcement programme in place. Well defined fisheries and fleet segments ensure that enforcement of a quota system should be effective. Costs will increase with a larger industry, but these should be offset by rising quota prices. A problem is that Denmark only has a share of an overall EU TAC on species, and Danish fishers may find themselves affected by the actions of other European players in the fisheries industry. Due to this competition between EU nation fishers, fishers may have a smaller incentive to comply with directives regarding sustainability, as the benefits might accrue to other nations.

Holland

ITQs are in place in the Netherlands. The initial allocation is free, and the national quota is provided by the EU. Allocation is based on catch history and vessel capacity. These rights are short-term only, and are leased on an annual basis. They have been fully transferable since 1985, but are non-divisible, although a portion purchase by many buyers is possible (Lindebo, 2001). Transfer approval is required. Quotas may be transferred between vessels that hold the same type of species quota, but may not be divisible in the sole/plaice fisheries. Holland has seen a 25% reduction in quota owners in the sole/plaice fishery.

Improved enforcement in the Dutch sole/plaice fisheries has resulted in stocks improving slightly, despite fluctuations in the past 2 decades (Lindebo, 2001). The price of quotas has increased. There has been a race to fish due to poor quota enforcement, both EU and national, but monitoring has improved since 1998.

Iceland

Iceland is approximately the same size as Newfoundland, and its fisheries are dominated by the capture of ground fish, in particular cod. Compared to Newfoundland, Iceland had a much smaller fleet and work force in its fisheries. Because of its independence, Iceland had to run its fisheries in an efficient way, and could not afford to subsidize them.

Quotas here are fully tradable, and this has not impacted on the livings earned by small scale fishermen as feared. A maximum holding of quota of 10% for haddock, and 20% for other species is imposed, although fleet restructuring has put pressure on these restrictions. Iceland has seen a concentration of quota with the ten largest quota holders owning one third of the over all quota (Lindebo, 2001). The herring fleet has decreased greatly in size since 1980, although fishing vessels are twice as efficient now. Research has shown rising profits in the fishing industry in the last few years, thanks to higher catches per unit of effort

In Iceland 0.4% of landings value is paid to the fisheries ministry to pay for the costs of monitoring and enforcement. Quota and license fees also bring in revenue for the fishing ministry. The size of the herring biomass in Iceland has risen in size between 1980 and 1993, but cod stocks suffered from years where the TAC was set too high. Some evidence for high-grading has been shown, especially in years of quota price increases.

Enforcement has been fairly easy due to few landing ports, and landing control systems and processing output monitoring, which have enabled high levels of enforcement. Penalties include fines and revoking of licenses.

Newfoundland

We look at Newfoundland as a separate case to Canada, as the experience in Newfoundland is unique. In 1992 and 1993, Newfoundland saw the almost complete collapse of its cod fisheries, and other groundfish stocks, and the closure of many of these fisheries. A large part of the more than 26 000 fishermen in the industry were forced into unemployment. The Canadian government supported these fishermen with various income replacement programs, and also introduced programs to encourage fishermen to leave the industry. These programs were highly inefficient, and controversial (Shrank, 1997).

Thanks to Newfoundland's status as a province of Canada, it gained access to federal funds which resulted in a heavily subsidized fishery. Newfoundland had a similar size fishery to Iceland, but their employment and vessel figures are greater by a factor of 5 or more. Newfoundland has a large coast line which is populated by families who used to rely on fishing as their main source of income. The fisheries are reported to have failed for the first

time as early as 1633. The fishery is charactarised by over population by fishers for a long time, and this has put great pressure on fish stocks, which completely collapsed in 1993. Newfoundland fishers had low levels of education, which have made it difficult to retrain fishers to other occupations. Previous financial support from the Canadian government made it possible for fishers to remain in the industry, despite their earnings from the fishery not affording them a living. In this way the fishery retained an inefficient and overly large work force.

Advances in fishing technology since the 1960s increased catches dramatically, resulting in the collapse of many fish stocks. Cod catches near Newfoundland have been falling since 1968, from over 2 million tons to just 50 000 tons in 1984. Following these declines approximately a quarter of the fishermen left the industry, and TACs were set for the first time, between 1968 and 1975. Falling cod prices thanks to the oil prices jolt in 1974 also affected the fishery, which was saved by government assistance programs which subsidized certain types of fishermen. These programs were phased out fairly soon however due to resistance from the US. In 1981 another economic recession caused the market for fish products from Newfoundland to collapse (Shrank, 1997). Government responded again by temporarily nationalizing many fish processing companies.

A lack of scientific knowledge of stocks resulted in excessive fishing, and as catch per unit effort figures remained high, thanks to improvements in technology, the absence of fish was attributed erroneously to environmental change. Failure to act quickly to lower TACs after more correct estimates on stocks were calculated led to an even greater decline in stocks. Once a small improvement in the stocks was noted in 1996, the government came under pressure to reopen the fisheries. During the period from 1972 to 1991, the Canadian government spent nearly 4 billion dollars on the fishery. These funds may have caused fishermen to remain in the fishery rather than seek alternative employment.

Measures used by the government included licence buybacks, early retirement of older fishers, retraining programs, income support, vessel maintenance programs and others. These programs were not very successful at reducing capacity, and the Newfoundland fisheries still suffered from excess capacity. Excess capacity provides an incentive to over exploit the resource.

New Zealand

New Zealand has a national fishery of 32 species. ITQs are in place in New Zealand, which allocate a percentage of TAC to quota holders. Their allocation was disrupted in order to redistribute quota to aboriginal peoples in New Zealand. Ownership of quotas is dependent on fishing company ownership being at least 75% New Zealand owned. Quota holders are restricted to a maximum holding of quota of no more than 35% of quota for a single offshore vessel in a given management area (Lindebo, 2001). Minimum holdings are also laid down for finfish, invertebrates, and other fisheries. New Zealand has seen an increase in concentration in the industry, and some concern for the continued presence of small scale players in the industry exists. New Zealand has seen an increase in the number of local vessels in the fleet, following the displacement of foreign vessels from the fleet.

New Zealand deals with the problems of by-catch and over fishing by different mechanisms, including under and over runs of quota which are balanced in the next year's quota, or having the fish surrendered to the state, paying the value of the catch and other mechanisms, with some mixed success (Lindebo, 2001). The size of the biomasses of New Zealand fishery species have improved under a regime of sensible ITQs. An increase in

efficiency and supply to markets has resulted in a much higher value of production in the New Zealand fisheries.

Initial quota allocation is free, and is based on catch history, participation actual catch and capacity. Quotas are transferable and perfectly divisible. A high capital value of ITQs has been created with considerable price increases. Full management cost recovery from industry is in place based on quota holding. There has been a rise in employment and in number of vessels in these fisheries. Harvest and quality have improved, as has efficiency. Enforcement is in the form of auditing of landings, sales and shipping records. Fish dealing requires a license, VMSs are used. High costs have been encountered, and co-management between government and industry has been introduced.

Norway

ITQs are used in Norway to avoid over exploitation. Ownership in the Norwegian Cod industry is dependent on the utilization of the quota. If quota is unused, it may be revoked. ITQs here are not tradable, as it was feared that tradability of quotas would impact on the livelihoods of small scale producers. Quotas are also not divisible. A system of quotas has become the permanent management system. To acquire more quota, vessel owners have to buy vessels with rights in the marketplace. However fishing boats are also bought and sold which do not have fishing rights which indicates the possibility of illegal fishing. Some concentration has occurred, but little or no restructuring due to lack of incentive.

The Norwegian fishing ministry recovers most costs of administration from quota holders. Initial allocation of quotas is free. No cost recovery is in place, making the central government the bearer of costs. This makes for an inefficient fishery. A quota utilization requirement is active, requiring at least 10% quota utilization. Stocks have been significantly rebuilt since the implementation of quotas. The fleet is characterized by over capacity, and due to restrictions on trade, there has been no concentration in the market. As these property rights are fairly weak, relatively poor economic results, and competition for catch and shorter fishing seasons have resulted. Enforcement has improved, not entirely due to the implementation of quotas.

The quota for individual vessels in sum exceeds the sum of the TAC, hence once the TAC is reached, no more fishing is allowed, regardless of individual vessel quotas. This has led to a race to fish situation.

United States

Minimum holdings are laid down for quota holders of surf clam and ocean quahog fisheries of at least 160 bushels. No maximum limitation is imposed. The US uses ITQs to manage these fisheries. These quotas are permanent. United States fisheries fleets have declined greatly in size – significant concentration has occurred. Clam stocks have improved since ITQs were introduced, although localized quahog over fishing has occurred. There is little or no evidence of a by-catch problem in these two fisheries. The license fee for these two species completely covered the administration costs, making the system self sufficient. Increased productivity, efficiency and capital utilization has occurred. On shore monitoring and fines and forfeiture are in place in these fisheries, and this enforcement has seen reduced costs.

United Kingdom

Licenses in the UK to fish belong to a particular vessel, and are conditional on a specific species and type of boat. Licenses are issued annually and can be transferred between vessels and ownerships. Vessels over 10 m long each have an individual quota, which are aggregated to group quotas and then allocated to producer organization. The Producer organizations may manage their group quotas as they wish. Limited quota trading is allowed, and a market has been established. Individual quotas are not divisible. Buying or leasing quota has risen in price, and some fishers have managed to withdraw from the industry and gain rents on the way out. There is no cost recovery at the moment for managing the fisheries. This may change if the cost of management rises. Penalties occur with concentration of licenses, although the majority of licenses are controlled by producer organizations.

UNOPS

United Nations Office for Project Services

The Chrysler Building
405 Lexington Avenue
New York, NY 10174 USA
Telephone: +1-212 457-4000
Fax: +1-212 457-4001
E-mail: unops.newyork@unops.org

Enviro-Fish Africa (Pty) Ltd

22 Somerset Street
Grahamstown
6139, South Africa
Telephone +27 046 622 8241
Fax +27 046 622 7950
Email: info@enivrofishafrica.co.za

BCLME
Benguela Current Large Marine Ecosystem Programme

BCLME Activity Centre for Living Marine Resources

C/o Ministry of Fisheries and Marine Resources
Strand Street
PO Box 525
Swakopmund
Namibia

ENVIRO-FISH AFRICA FEIKE UNIVERSITY OF CAPE TOWN tralac BRUCE SHALLARD AND ASSOCIATES
Strategic Fisheries Management Advisors

THE CONSORTIUM