

**OPTIONS FOR THE ALLOCATION OF
ACCESS RIGHTS FOR DEMERSAL
RESOURCES IN SOUTH AFRICA -
PRACTICAL LESSONS FROM OTHER
FISHERIES AROUND THE WORLD.**

by

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Executive summary

There is an ongoing process of deliberation in South Africa regarding the allocation of access rights to the country's living marine resources. A large number of interest groups, representing different motives and objectives, are seeking to affect the decision-making process. Interestingly, despite the different motives and convictions of these groups, they use similar arguments to defend their position and all of them are convinced that their approach will ensure "the sustainable utilisation and conservation of South Africa's living marine resources" and "maximum long-term socio-economic benefits".

The large number of interest groups, and the political nature of the decision-making process, raises the possibility that decisions over access rights to the fishery will be based not on informed and reasoned analysis, but rather on ideological and emotive arguments with political undercurrents. The purpose of this study was therefore to examine examples of a number of mainly demersal fisheries in other countries to promote a pragmatic and informed approach to the setting of fishing policy for South Africa.

The main conclusion from this study is that the issue of the management of fish resources and control over the rights of exploitation cannot be addressed in isolation from global economic and social developments. The concept of the artisanal "noble fisherman" is based on the demographic realities of the past century. The world's human population has doubled since the 1950's, and has increased sixfold since 1800. Demand for both land and sea resources is increasing exponentially, and while it is still possible to increase food production from farming and aquaculture, this option is not available for fish resources, which have limited production potential and are already considered to be overexploited on a global basis.

The only way to optimise production from fish resources is to maintain stocks at a size that allows high sustainable production. This can be achieved only through strict control and the enforcement of fishing regulations. The fragmentation of access to the fishery and the dissipation of economic rent makes control of the fishery difficult because of the dependence of fishing populations on the resource for their daily survival.

It was also found that although large scale abuse of fish resources can be carried out by either a centralised industrial sector or by a fragmented artisanal one, while the former can be harnessed and controlled relatively easily, the latter cannot. In addition to the loss of potential production and economic rent there are major difficulties in artisanal, community base fisheries with regard to enforcement of fishing regulations and gathering of essential catch data. As a result the resource is continuously maintained at a low biological state, poor fishermen become poorer, and prospects for improvement are increasingly limited.

Management regulations controlling access invariably favour preventing pre-emption of one group of participants by another. On a social level this may at first appear unsatisfactory. However, there are strong arguments to support the view that it is most fair and equitable to the nation as a whole to have an allocation that maximises the benefits that the nation can receive from its resources. These benefits can then be used to promote both the economic *and* social development of the country, thereby removing the perceived dichotomy between social and economic objectives. The case studies have shown that the industrial sector is most likely to provide maximum economic benefits from the fishery and should thus be favoured in the allocation of access rights.

Introduction

There is an ongoing process in South Africa deliberating policy over the allocation of fishing rights to South Africa's limited marine resources. This discussion is being driven by a number of different motives:

1. **The democratisation motive** - the need to remove the secretive, autocratic and bureaucratic manner in which fishing rights and management decisions have often been dealt with in the past.
2. **The formalisation motive** - the need to construct a fishing policy which will formalise and clarify the framework by which fish resources are allocated and managed.
3. **The social motive** - the need to transform the fishing sector from its current predominantly industrial form, to include a larger artisanal fishing community, possibly even on a subsistence basis, and to ensure a more equitable distribution of fishing rights.

On the basis of these issues, there are several major interest groups which are trying to effect the decision-making process in ways that will fulfil their own objectives:

1. The existing established industry, which believes that its fishing rights were earned and not given, and which is seeking to protect its commercial interests and previous investment in the South African fishery.
2. Labour groups within the industry (fishermen and factory workers) who want better security and higher earnings from their traditional form of occupation.
3. Coastal communities who live in proximity to the resources, and as such, believe they have the right to benefit from them.
4. Politicians who see the allocation of fishing rights as political tools, either to advance their own political careers, or to promote their own political convictions.
5. Opportunists who see the present turmoil in the industry as a way of getting access to the fishery.
6. Other groups - scientists, environmentalists, the general public, recreational bodies and others who have a variety of interests, concerns and convictions about the conservation and utilisation of South African fish resources .

Although these groups have very different motives, they all use similar rhetoric in statements about resource utilisation, which broadly speaking can be summarised as follows:

the sustainable utilisation and conservation of South African living marine resources in order to derive maximum long-term socio-economic benefits.

Discussion about how to achieve this objective centres around two main issues:

1. in seeking to achieve some form of equity when the control of access to fish must by definition affect the privileges of different interest groups, will society be better served by adopting a social welfare approach or by pursuing pure economic criteria.
2. what are the comparative merits of artisanal versus industrial fishing activities.

Regulation of fishing, which is made necessary by the limited nature of fishery resources, implies a control of the participation in fisheries and the distribution of the riches produced by their exploitation. The question of allocation is concerned with deciding how the net profits derived from the fishery are to be distributed between present and potential operators. Clearly political, economic and social factors all have an impact on the decision making process. These factors, and the large number of interest groups in South Africa, raise the potential for impartial and subjective decision making over access rights to the fishery that will be based not on informed and reasoned analysis, but rather on ideological and emotive arguments.

Against this background it was felt useful to examine the experience of other countries with regards to access arrangements, and to understand and learn from their experiences. The following document is therefore an attempt to present a pragmatic and factual view of the issues currently being discussed in South Africa. How, for example, have other fisheries resolved or addressed conflicts and issues surrounding access rights? What were the biological, social and economic consequences of these different approaches? What lessons can we learn from these approaches and what should we take cognisance of when formulating the South African policy on fisheries management and access control?

The following review presents a collection of case studies from around the world and concentrates largely on demersal resources, as these are felt to have particular relevance to the discussion about access to the resources of South Africa. Most of the information in this document has already been

published in the form of books, scientific papers and internal reports, and these are acknowledged in the text. It has not been possible within the scope of this report to present all the relevant information due to limitations on its length, the desire to make the report readable, clear and informative, the complex control structures in many fisheries, and poor data and reporting in many parts of the world. The result is that certain cases are presented in more detail than others, for which less information was available or which were felt to be of less relevance to the South African situation. Nevertheless, we believe that certain clear lessons and conclusions can be drawn from the review. These are discussed in a concluding section to each case study, and in the final Conclusions and Recommendations.

The rise and the fall of the Canadian Northern Cod fishery (*Gadus morrhua*)

(*History and Management of the Fishery for Northern Cod in NAFO divisions 2J, 3K and 3L. by W H Lear and L S Parsons in Perspectives on Canadian Marine Fisheries Management - Canadian Bulletin of Fisheries 1993, and from: Aquatic Sciences 226 and The Management of Marine Fisheries in Canada by L S Parsons: Canadian Bulletin of Fisheries and Aquatic Sciences 225. 1993*)

Overview

Although steam trawlers were first introduced to the waters of the Atlantic coast in 1908 and fish processing technology was also developing rapidly at this time, it took almost another 40 years for the industrial cod fishery in Newfoundland to develop. As a result of strong resistance from inshore fishermen who saw the trawlers as a threat to their livelihood, the use of trawlers was severely restricted under the assumption that this would protect employment in the fisheries sector. The result however was that poor fishing communities with low productivity, were for many years, utilising a resource that had huge economic potential. It was only with the increased demand for fish products during World War II that the Newfoundland fishery was finally opened up to full industrial exploitation, and that the salted cod trade on the Atlantic coast developed along with the establishment of a filleting and freezing industry.

In 1977 Canada extended its exclusive economic zone (EEZ) to 200 miles and established a rebuilding $F_{0.1}$ harvesting strategy as catches had not been reaching TAC's and there were signs of overfishing. Initial calculations by scientists from the Department of Fishery and Ocean (DFO) suggested that the new management system would manage to halt stock decline, and estimates were made that the 3+ years stock would triple by 1984 to 1.2 million tonnes (from its 1976 level of 450,000 tonnes). In 1979 DFO scientists calculated a resource surplus production of 4+ years fish based on the historic average which included the strong years of the 1960s and early 1970s. This calculation estimated that by 1985 the TAC could be as high as 350,000 tonnes compared with the 1979 level of 180,000 tonnes.

The above estimates, and the extension of the Canadian jurisdiction to 200 miles, created euphoric perceptions among the general public that unlimited stocks of cod would become available to Canadian fishermen. In 1979 a seminar on the Northern Cod management policy took place during which the stock estimates and projections made by the DFO scientists were presented, and the Minister declared that the Northern cod resource belonged to the people of Northeast Newfoundland and Labrador. The Minister stated that "for the people working in processing plants, for their families and the communities in which they live, the right and the ability to reap this harvest is indispensable, because they have a special, very special relationship to these stocks". It was declared in this seminar that the current Newfoundland east coast inshore fleet would be capable of catching the projected 350,000 tonnes in 1985. Following the seminar, the guidelines were released by the DFO which included allocating two-thirds of the TAC to the inshore sector, and placing some control on the number of units in the inshore fishery.

The concept of a quota for the inshore fishery was short-lived. In 1982, a fixed amount of 120,000 tonnes was set for the inshore sector (from a total TAC of 200,000) since it was evident that the inshore sector was not capable of catching its full quota allocation. It was decided that the quota for the inshore sector should be calculated on the basis of an average of a number of years in order to prevent expansion of effort in good years and contraction in bad years. This resulted in a more even distribution of the TAC between the inshore and the offshore sectors on the basis of a 55:45 split.

Also in 1982, the federal government announced the formation of a Task force on the Atlantic Fisheries with a mandate to advise the government on long term fishing policy, and to advise the government on specific requests for assistance from the industry. In 1983 the task force published its recommendations which were based, in hindsight, on grossly over optimistic assumptions. It was projected that the TAC for Northern cod would almost double between 1982 and 1987, from 230,000 tonnes to at least 400,000 tonnes. These projections gave the formal go ahead to a massive program of expansion of both fishing effort and onshore processing capacity which had already begun following the declaration of the 200 mile EEZ. A fleet of longliners was developed on the faulty assumption that catches were low because of low technology, but were put up for sale when TAC's had to be lowered a few years later, and during the entire period of their operation from 1986 to 1990 they were allocated and caught only 7,800 tonnes of cod. The huge inshore processing industry which developed, would also in later years be underutilised and put enormous pressure on the resource through the requirement to ensure all year round productivity.

The task force recommendations on the Northern cod were accepted by the federal government and shaped fisheries policy for the next several years, but were frustrated by the failure of the stock to grow at the projected rate, if at all. TAC's had been continuously increasing from 180,000 tonnes in 1980 to 266,000 in 1984, while catches from the inshore sector had been steadily declining from 113,000 tonnes in 1982 to 72,000 tonnes in 1986. At the same time, catches from the offshore fishery, partly as a result of the introduction of a factory freezer trawler in 1985 (which was vociferously opposed by inshore fishing groups and workers unions), had increased from 79,000 tonnes in 1980 to 179,000 tonnes in 1986. The TAC was lowered to 256,000 tonnes in 1987 but raised again to 266,000 tonnes in 1988 to accommodate demands made by the offshore sector. The inability of the inshore sector to fill its TAC while the offshore portion of the TAC was increasing, lead to a serious rift in the industry, and to much debate among scientists.

Stock assessment work in 1986 suggested that the resource 4+ biomass (estimated at 1,228,000 tonnes) was three times its 1977 biomass, and that the 7+ biomass (estimated at 582,000 tonnes in 1986) was seven times larger than the 1977 estimate. The failure of the inshore fishery was blamed on unique "environmental conditions", rather than on overfishing. The Task force recommended a more cautionary approach and suggested an annual TAC below the $F_{0.1}$ level, but stated that there was no need for major concern.

Meanwhile the Canadianization of the Northern cod fishery, as recommended by the Task force to transfer full ownership of the fishery into Canadian hands, had been progressing. The foreign fleet allocation was reduced from 20,000 tonnes in 1983 to 9,500 tonnes in 1987. In 1989 and 1990, Canada left only 2,950 tonnes and 2,262 tonnes respectively for French fleets as part of the Canadian-French interim agreement on allocation of fishing quotas. This was virtually the end of participation by foreign fleets in the Northern cod fishery. However, part of the offshore cod resource migrates across the 200 mile exclusive zone onto the nose of the Grand Banks. Spain, disregarding North Atlantic Fishery Organisation (NAFO) quota restrictions and recommendations, continued to fish for cod on the Grand Banks, and this would later result in the "fish war" between Canada and Spain in 1994/5.

In January 1989, CAFSAC reassessed the status of the cod in Divisions 2J, 3K and 3L. The resulting assessment was a bombshell that destroyed all previous perceptions of the state of the cod resource. CAFSAC recommended that the 1988 $F_{0.1}$ TAC of 293,000 tonnes should be adjusted to 125,000 tonnes for 1989, principally as a result of the conclusion that the real value of F (fishing mortality coefficient) was about double the value previously estimated. As a result of the 125,000

tonne estimate, the 1989 TAC was reduced, but only to 235,000 tonnes, and the TAC for 1990 of 197,000 tonnes was also much higher than the new recommended $F_{0.1}$ TAC. In 1990, a “New Management Panel” (NMP) supported the new $F_{0.1}$ level recommended by CAFSAC, but the government rejected a further reduction in the 1990 TAC.

Early in 1992 CAFSAC advised that the 3+ biomass was still declining and estimated that it stood at 800,000 tonnes, and that the spawning biomass (7+) was 130,000 tonnes, the smallest ever observed. In response the 1992 TAC was reduced to 120,000 tonnes. Further estimates by NAFO scientists suggested that the 3+ biomass was between 520,000 and 640,000 tonnes, and that the 7+ biomass was between 72,000 and 110,000 tonnes (note the 1,228 thousand tonnes for 4+ biomass and the 582,000 tonnes for 7+ biomass in 1985). Following this estimate, attributed to an environmental anomaly, and with blame being placed on Spanish activities outside of the 200 mile exclusive zone, the Minister declared a two year moratorium on the Northern cod fishery on 2nd July 1992. The moratorium directly affected 19,000 people.

Management

Prior to 1950 there had been virtually no effort or quota control of the Newfoundland cod fishery. Access was open to local and foreign participants, and policing was carried out only in order to prevent personal conflicts between the large number of participants operating in the fishery. In 1950 the International Commission on North Atlantic Fisheries (ICNAF) Convention entered into force, and the Commission was given the mandate “to make possible the maintenance of a maximum sustained catch from the (ICNAF) fisheries”. Early regulations dealt with mesh size and otter trawl construction features, and the first TAC for the cod stock was issued in 1972 of 575,000 tonnes with an additional 90,000 tonnes for the inshore fishing sector (3 miles from the coastline). Productivity from the fishery was poor during subsequent years however, and the TAC for the next four years was higher than actual catch levels indicating that the fishery had by this time already been heavily overexploited. It was only in 1977 and 1978 that more realistic TAC’s of 160,000 tonnes and 135,000 tonnes respectively were set.

From the early 1970’s there were number of attempts to restrict participation in the industry. In 1976 a freeze was introduced on the licensing of small otter trawlers, and in the same year the First Ground Management Plan was implemented with the following objectives:

1. Conservation and restoration of all fish resources.
2. Accessibility of all Atlantic fishermen to the fish resource, based on the state of the resource and other rather ill-defined criteria.
3. Co-ordination of the deployment of mobile fishing fleets.
4. Provision for the withdrawal of excessive catching capacity.
5. Full utilisation of the resource.

In practice the First Ground Management Plan was a complex system of quotas and access rules based on vessel type, gear classes, allowance for inshore vessels, closed seasons, limits on the number of trips per month, and catch limits per trip. These regulations reflected a large number of compromises between different interest groups in the fishery, rather than a well thought out and planned management policy.

There were a huge number of participants operating in the inshore fishery at this time, all demanding a greater share of the resource. The problem was further intensified by increased fishing effort on the Northern cod resource, following the virtual collapse of the Gulf of St. Lawrence Redfish fishery. Some of the large Nova Scotia and Newfoundland offshore trawlers had moved from the Gulf of St. Lawrence towards the Northern cod grounds. These trawlers were encouraged to fish for cod during the winter months and to assist the inshore industry in summer when they could not fulfil their quotas. The development of this winter offshore industry sparked inter-provisional rivalry between Nova Scotia and Newfoundland over the right to fish and process Northern cod caught in “Newfoundland waters. Each group suggested different access control measures, with maximum allowable catch per trip, maximum number of trips, and closed seasons

without curtailing catch directly, all suggested as possible methods of access control. The result of the conflict was a mixed bag of restrictions that attempted to satisfy everybody but actually satisfied nobody.

By 1977 the local inshore fleet had grown to about 10,000 vessels of different sizes. Competition for the resource was intense, with conflict common between large trawlers and smaller vessels, hence the second objective of the Ground Management Plan stated above. In practice, the belief that it would be possible to develop a system of allocations satisfactory for all interest groups proved elusive, and the issue of who was to be allocated rights to the Northern cod resource preoccupied the entire fishing community for many years. A complex list of criteria were used to allocate access to the resource such as, proximity to the resource, dependency of the community on the resource, and efficiency of particular sectors of the fishing fleet, with the so-called social criteria given more weight than economic ones.

In 1979 attempts were made to slow down the flow of new entrants to the fishery, and a moratorium was declared on all vessels greater than 35 feet in length. In 1980 inshore fishermen were divided into two categories; full-time and part-time. This classification did little to limit effort in the fishery, but the later introduction of groundfish fixed gear licenses for full-time fishermen did have some positive effects.

The euphoria that followed the declaration of the 200 miles exclusive fishing zone, and the faulty stock assessment calculations at the time, provided the politicians with an opportunity to address conflicts over access and to keep everybody happy by increasing the TAC throughout the 1980's to accommodate the ever increasing demand for access rights. The result was a huge increase in fishing effort since access to the resource was virtually open to everybody who complied with certain key social criteria as listed above.

Conclusions

This short review of the history of the Northern cod fishery highlights a number of important conflicts over access to the resources:

1. an international conflict between domestic and foreign fleets. Foreign fleets had little incentive to comply with regulations and to protect the long term future of the stocks. Serious conflict also arose over the activities of foreign vessels outside the 200 mile EEZ that affected straddling stocks.
2. a regional conflict between different coastal provinces sharing the same resource, centred around the dispute over the right to fish and process cod between Nova Scotia and Newfoundland.
3. a local conflict between the inshore and offshore sectors resulting from the activities of offshore vessels in inshore waters at certain times of the year, and the provision of an inshore quota.
4. conflict on an individual level for fishing rights, as large numbers of vessels were operating in the inshore fishery.
5. and a biological/economic conflict between various authorities and scientists with regards to management decisions and fishing regulations, particularly the setting of TAC's. Large numbers of participants in the fishery increased the political pressure to maintain high TAC's when, from the point of view of managing the resource, they should have been lowered.

The case study demonstrates that the problem of overfishing experienced in the Northern cod fishery in Canada was centred around three main factors:

1. faulty scientific estimates of stock biomass and inappropriate TAC's, principally resulting from erroneous estimates of the fishing mortality coefficient. These estimates encouraged overcapitalisation in both vessel capacity and onshore infrastructure, which, with the decline in fishing, had to be decommissioned and closed down.
2. a policy on access to resources that attempted to satisfy all interest groups. As a result, policy formulation on access control was confused, with a multiplicity of control measures satisfying

nobody. Economic criteria were neglected in favour of social criteria, and political influences helped to shape policy in a way that was not in the long term interests of the fishery.

3. the fact that fish stocks in general, and the Northern cod stock in particular, do not recognise artificial human boundaries and agreements. In the winter the northern cod aggregate in the offshore banks prior to the spawning season and are fished by the large deep water trawlers, and in spring and summer the stock moves to the inshore banks to feed and is then targeted by the inshore fishing industry and the fixed gear operators (mostly traps). The stock was therefore fished by two different sectors under the false political notion that they were two different fisheries.

The Atlantic *Halibut* (*Hippoglossus hippoglossus*) and the Pacific Halibut (*H. stenolepis*) fisheries

(Review of Atlantic Halibut (Hippoglossus hippoglossus) and the Pacific Halibut (H. stenolepis) and their North American fisheries by R J Trumble, J D Neilson, W R Bowering and D A McCaughran: Canadian Bulletin of Fisheries and Aquatic Sciences 227. 1993)

Overview

North American halibut are typically found along the continental shelf of the sub-Arctic North Atlantic and North Pacific Oceans. They are generally a deep water species (200 - 500 m) although they can be caught in shallower water between 100 m and 200 m. Until the late 1800's, the halibut fishery was principally an artisanal Indian fishery, with non-Indian fishermen using halibut only for bait or just discarding it from cod bycatch. By the late 1800's however this perception had changed, and halibut fishing became commercial in both Canada and America. At this time halibut of over 100 kgs were common, and were mainly caught using a handline or a primitive form of longline.

In the early 1900's, vessels were introduced to the fishery which were capable of hauling longlines directly from the deck, and with the transition to round hooks the fishery became increasingly efficient. At the same time, quantities of Atlantic halibut were also being removed from the fishery by newly introduced otter trawlers. Otter trawlers were catching much smaller halibut than the longline vessels, and this caused conflict between traditional line fishermen and fishermen who were trawling. As a result, trawling for Pacific halibut was prohibited in 1944. The Atlantic halibut however continued to be caught as bycatch by otter trawlers until new regulations in Canada, aimed at discouraging targeting, restricted the quantities of Atlantic halibut that could be retained by trawlers.

On the Pacific coast in the 1960s there were 200-300 longline boats which were principally targeting the Pacific halibut. However, since this fishery was not regulated, the collapse of other parallel fisheries such as king crab and limitations on entry to other fisheries, attracted many fishermen to the Pacific halibut fishery such that by the 1980's, the halibut fleet had increased to 4,264 active vessels, with another 2,270 vessels registered but not necessarily active.

Catches of Atlantic halibut rose from about 1,500 tonnes in 1976 to 2,400 in 1990, with record catches of over 4,000 tonnes in 1985. The Pacific halibut fishery however was more productive, and catches rose from over 16,000 tonnes in 1976 to about 37,000 in 1990, with record catches of over 44,000 tonnes in 1988. A review compiled at the time indicated that catch rates of Atlantic halibut had dropped by a factor of three between 1980 and 1986 (drastic increases in catch rate for Atlantic halibut between 1976 and 1978, and between 1987 and 1988 are attributed to new types of hooks being used rather than actual population trends). For Pacific halibut, which was better controlled by the Canadian authorities, there is a better correlation between catch rates and the estimates of total exploitable biomass (using trends in age structure as an indicator), and indications are that the biomass of exploitable resource has more than doubled since the early 1970s. However,

between 1986 and 1990, there was an annual decline in catch rates of 5% to 10% suggesting non sustainable fishing.

Management

The US and Canada have taken very different approaches to managing entrants to the halibut fisheries. Prior to 1988, the small Canadian Atlantic halibut fishery was unregulated. Canada still maintains an open access system with a global TAC and effort control through gear type and boat size. During the mid 1980s growing concern about the state of the resource triggered the formation of a special halibut working group to advise the Ground Fish Advisory Committee (GAFF). As a result of the work of this committee, a number of management regulations were introduced in 1988 including a minimum size (81.3 cm), a variety of regulations to control landings of Atlantic halibut as a bycatch, and a mandatory observer program. The Pacific halibut has been better controlled over the last few decades and no bycatch of the Pacific halibut may be retained. This has not prevented bycatch mortality and discards altogether however, since large quantities of Pacific halibut are caught as bycatch from cod trawling, but the regulation has prevented intentional targeting for Pacific halibut by trawlers under the bycatch disguise. In Canada license limitation on entries to the Pacific halibut fishery was in effect from 1977. In addition, fishermen that did not meet certain performance criteria were also excluded from the fishery. In 1991, Canadian fishermen requested a share quota system which was to set quotas for both the target species and its bycatch, and this was consequently implemented in 1991.

The current lack of Atlantic halibut in US waters precludes the need for regulation of this fishery in the US. The increase in the Pacific halibut biomass during the 1980's, decline in the catches of the red king crab in 1982, and entry restrictions imposed on the salmon fisheries led to a massive increase in fishing effort for the Pacific halibut by American fishermen. In 1987 the entire 30,000 tonnes quota for the Gulf of Alaska Pacific halibut resource (70% of the global TAC), was taken in just three days of fishing! This compared with a 40 day fishing season in the 1970's for just 12,000 tonnes. The reason for this rather absurd situation was that ever increasing effort coupled with increasing catch rates, despite TAC limits, resulted in shorter and shorter fishing seasons. New boats were entering the halibut fishery because of good catch rates and good prices, and because equipment for longlining was relatively cheap. With the large number of participants in the fishery and the very short fishing season, it became extremely difficult to ensure that the TAC would be fulfilled without either overfishing or underfishing. In addition, the concentrated supply of product over such a short period of time meant that much of the fish had to be frozen, thus preventing it from being sold on the higher quality fresh fish market. Other problems have included the abuse of regulations as there were too many boats and people to control, conflicts between fishermen, and lost fish and equipment on overcrowded fishing grounds. Current management thinking is considering introducing a limited entry system to the US Pacific halibut in 1995.

Conclusions

Both the Pacific halibut fishery and the much smaller Atlantic halibut fishery have exhibited signs of overfishing since 1988, although the problem is not thought to be too severe. America and Canada have taken different approaches to fisheries management, with Canadian management, based on performance criteria and a bycatch restrictions based on a share quota system being relatively successful. The American management of Pacific halibut based on global TAC's, provides a classic demonstration of the overcapitalisation that occurs when quotas are not individually based. With profits to be made from the global TAC, and no control on the access to a share of this TAC, effort continued to enter the fishery forcing the fishing season to become shorter and shorter. Control of access on the basis of global TAC's often results in seasonal disruption to onshore processing facilities with serious economic and social consequences. In addition, the case study shows that large number of participants in a fishery increases the tendency for regulation infringements and problems of policy enforcement.

Review Of Major Hake Fisheries Around The World

(Extracts From The Book: Hake Fisheries, Ecology And Markets, Chapman And Hall Fish And Fisheries Series 15 - Edited By Jurgen Alheit And Tony J Pitcher - 1995)

Hake fisheries around the world started to develop on a large scale only after depleted cod stocks around the world were unable to meet market demand during the 1950s and 1960s. Initially hake caught outside Europe was used as pet food or as fish meal, but today many forms of value-added product exist on the international market. At present almost 2 million tonnes of hake are caught annually in both Northern and Southern Hemisphere Atlantic and Pacific waters. The global biomass of hake is estimated to be 10-12 million tonnes with a global sustainable yield of between 1½ and 2 million tonnes. Hake stocks in the majority of fisheries around the world are generally slightly over-exploited, with the Mediterranean and the North-west Africa stocks considered to be heavily overexploited. South African and the Namibian stocks are stable and perhaps even slightly increasing, stocks in the eastern Pacific are slightly under-exploited, while some deep-water tropical stocks still remain in a pristine condition.

The South African Cape hake fishery (*M. capensis* and *M. paradoxus*)

(Chapter 2, A.. Payne And A.. Punt In Hake Fisheries, Ecology And Markets, Chapman And Hall Fish And Fisheries Series 15 Edited By Jurgen Alheit And Tony J Pitcher - 1995)

Overview

Up to about 1905 there was little demand for hake in the South African fish-market and hake was not systematically exploited. The “pre-industrial” fishermen of the Western Cape landed a mix of species made up mostly of snoek, and hake was landed in very modest quantities. However the stable nature of the hake resource and its year round availability made it an ideal target for steam trawlers.

The South African industrial trawl fishery was based on steam power and originated in 1904 in Cape Town with the formation of the African Fishing and Trading Co. by G. D. Irvin (from the family that pioneered steam trawling). As is often the case with pioneering fishing operations, the company soon failed but picked itself up again by entering into a co-operative agreement with C.o. Johnson, then fishing out of Durban. Although the fish resources at the Cape were acknowledged to be abundant and potentially profitable, the new arrangement again lost its capital within two years, and this began a pattern for the developing trawling industry that has persisted even to the present day, demonstrating the risky nature of fishing operations. Further capital was procured, the two pioneers entered into partnership in 1910, merged as I&J in 1912/13, and registered as a public company in 1922.

Johnson and Irvin soon found that they had to conform to realities that have since shaped the industry, namely inordinate capital demands, geography and the location of the principle market on the Witwatersrand. The local market was intrinsically over-supplied and it was clear that the key to success lay not only in the development of an efficient fishing fleet but also on the development of an efficient distribution network and international marketing system. I&J succeeded by the creative use of rail transport, setting up inland depots and investing in a sophisticated distribution network. These innovations allowed I&J to establish a healthy demand for a fish species that had not been fully commercialised until then. Vertical integration into processing, typically identified with the industry from its very earliest days, followed naturally from the need to handle fish through all market stages.

Concentration on cost effective distribution meant that African Fishing and its successor dominated the SA trawling scene completely, at least until 1970. However, at no stage did I&J operate in a competitive vacuum for long. Amongst the earlier firms were: SA Fisheries & Cold Storage 1902-1914, Consolidated Whaling and Deep Sea Fishing -1914, Ovenstones, National Trawling 1936 - 1954, Gelcer and CO, East Fisheries 1935 - 1947 and Friedman and Rabinowitz.

The trawling interests of these concerns had largely disappeared by the mid 1950's and I&J had itself been bought by Anglo Transvaal Industries in 1951 after the death of Johnson. The industry witnessed a constant flow of new entrants, liquidation, amalgamations and take-overs with the principal survivor being the only organisation that mastered the economics of national fish distribution, and generated the surplus capital needed to renew efficient fishing fleets.

By 1960 the development of the trawling industry had become static. The marketing network provided full coverage of urban centres and innovation was no longer evident. Price control on hake had been retained. It seemed that the hard fought battle for the domestic market had been decided and the industry had settled into a natural monopoly. Almost uniquely for fisheries, the abundance of the resource itself was not in question. Things were soon to change radically regarding both market structure and resource productivity.

Amalgamated Fisheries (later Atlantic Trawling) was the first of the new entrants to enter the domestic market. The company introduced purpose built stern trawlers to South Africa and installed the most advanced processing plant in the country, creating a new brand. Kaap Kunene followed in 1963 with five large ships including the first freezers. These investments were all very considerable but were absorbed one way or another by even larger companies between 1967 and 1980.

Sea Harvest Corporation (1964) emerged as a major force by virtue of the capital resources and the marketing and catching capabilities of its parent companies. The Saldanha based company concentrated on processed packaged hake in local and export markets, but its future remained in doubt until it obtained a firm foothold in the domestic market which took at least ten years. Marine Products, wary of the state of competition, also invested in trawling by way of a large capital injection into I&J (1965).

It was at this time that the trawling industry laid the basis for the modern SA frozen food industry; applied food technology, branding and the product disposal infrastructure allowed frozen packaged fish products, and soon thereafter a range of other foodstuffs, access to all localities and a variety of retail outlets. Retail distribution of fish was upgraded to a level such that the country could claim to be a world leader in the field. Advances in quick freezing, mechanised fish filleting and the introduction of factory freezers revolutionised the industry and enabled it to increase its export performance significantly, so that by 1970, 40% of trawling sector output was consigned to foreign markets. Competitive exploration led to the discovery and exploitation of important new fishing grounds.

The foreign "discovery" of the SE Atlantic Hake Fishery plunged the industry into crisis, the after effects of which remain today. Most of the major cost and supply problems experienced since the early seventies had their origin in foreign involvement in the fishery. From 1963 onwards distant water fleets pillaged fish stocks in the adjacent waters with growing intensity. The continued existence of the domestic industry was brought into serious question. In less than ten years the South African hake catch in the SE Atlantic fell to 15% of the previous total and CPUE (catch-per-unit-effort) fell by more than two thirds.

The Third Law of the Sea Convention was in continuous session from 1973 onwards and it was apparent that 200 mile exclusion regimes would be universally adopted. A draft clause in the Convention document laying down that nations without the capacity to harvest the MSY (maximum sustainable yield) should accommodate foreigners to achieve that goal, worried the authorities. Trawling companies were urged to expand fleets to build up national performance and newcomers were strongly encouraged to take part, but no newcomers came forward. Second hand ships turned out to be the only way to acquire tonnage fast enough to respond to the perception that "performance" had to be improved. Enough ships were bought so that South Africa deployed

adequate fishing effort to enable it to take the estimated Maximum Sustainable Yield in the future EEZ.

The International Commission for the SE Atlantic Fisheries, which was set up to put a stop to the ruination of the hake fishery, agreed on an initial TAC of 165 000 tons for 1977; 110 000 tons being reserved for the Coastal State. It proved to be a bad year with no indication that foreign effort was actually being reduced. The domestic trawling industry was plainly on its knees. A Fisheries Zone extending 200 nautical miles offshore was promulgated in November 1977.

Policy was directly reversed and the Government discouraged additional vessel acquisitions or new entrants into the hake fishery because additional investment would be counter productive, harming a resource where the amount of fishing effort had been successfully reduced to the desirable and rational level (that needed to realise the MSY in the longer term). South Africa was in a uniquely good position: the traumatic restructuring invariably linked with remedying over-fishing situations was to be borne by the intruders. The Government, while not excluding foreigners entirely, swiftly reduced the foreign presence.

A pilot domestic TAC (total allowable catch) was set for 1978 but it was widely realised that a so called "global quota" was ineffective. Capital resident in the fishery crept upwards as participants competed to improve their positions in anticipation of the final step in the evolution of rights. Company quotas were introduced in the Deep Sea Trawl Fishery in 1979; the three foundation companies receiving 95% of the domestic TAC with the balance to three newly established smaller enterprises. The 28 small inshore boat owners that traditionally trawled for sole in addition to hake affiliated and have kept a separate identity since 1978. These trawler owners obtained individual quotas in 1982. As in all fisheries, the recognition of individual rights in the resource created a watershed for the future. The Industry was assured that after its "time of troubles" and its successful efforts in furthering national interests under difficult circumstances, it would be able to operate indefinitely on an established basis even if the TAC should vary in future.

Annual TAC, steadily subject to better computation, peaked in 1980, fell 23% by 1983 and has since grown slowly to within 5% of its 1980 level. The familiar cycle of business failure and consolidation continued even during this more stable phase, and the ownership of two thirds of Deep-Sea Trawling Industry quotas changed hands in the period from 1979 to 1983. The advent of a new Minister brought another policy to the fore in 1984. Quotas were reallocated and new entrants were injected into the fishery. In consequence of the resultant turmoil the Government introduced the 80/20 agreement, allowing new entrants into the fishery at a controlled rate, and appointed the Diemont Commission to report on questions pertaining to fishing rights (1985). Its recommendations that existing rights and agreements be honoured and a Board be set up to allocate quotas, were accepted.

The Quota Board which was established under the Sea Fishery Act (1988), and first sat in 1990, brought 25 new parties into the hake industry under the 80/20 agreement. This arrangement had itself enabled the authorities to allocate hake quota rights in the preceding period to 25 new parties. In addition to augmenting some of these newcomers the Board has since allocated hake quota to at least 38 new entities including 28 quotas granted to Trusts formed to promote economic development in fishing communities. With the exception of addressing an "anomaly", it has not permanently allocated any of the incremental hake TAC to quota holders pre-dating 1986.

In summary the present day structure of the vertically integrated trawling industry is largely explained by regional demography, geography and the role of international competitors. Historical developments throughout this century have also borne heavily on the form and character of the trawling industry. Rights currently held are the product of more than 90 years of endeavour and progress, and are marked by many failures and a few successes culminating in the present form of existing participants.

Management

Between 1977 and 1983 the TAC in South Africa was set based on recommendations from the ICSEAF. From 1983 South Africa took control of the management of its hake resource and a

rebuilding management strategy was established based on a $f_{0.2}$ harvesting strategy. This management strategy has aimed to allow the resource to recover by setting an annual TAC below the estimated sustainable yield of the resource. This management initiative required the TAC to be lowered initially but has been followed by a gradual increase in the TAC as the resource biomass has increased as indicated by catch rate indicators. The management system was adopted and supported by the industry on the understanding that 80% of any annual increase in future TAC's would be returned to the existing industry. However as a result of the changing political conditions in South Africa, pressure is now mounting to allow new entrants into the fishing industry through the allocation of quotas, either from the "surplus" TAC, or by transferring quotas from existing quota holders. Annual catches are around 150,000 tonnes and the resource appears to be stable or even growing slightly. In recent years the proportion of bycatch species in catches has increased significantly: horse mackerel, which is still a non quota species but can be fished by hake quota holders, is a particular case in point.

The Namibian hake fishery (*M. capensis* and *M. paradoxus*)

This fishery dates back to the mid-1960's, when foreign fleets and South African vessels first targeted stocks of *M. paradoxus* and *M. capensis* in Namibian (South West Africa at the time, under illegal occupation by South Africa) waters. A period of unregulated fishing occurred from 1964 to 1980, and catch levels reached a maximum of 820,000 tons in 1972. As catch rates declined after this date, catches declined, reaching a low point of 172,000 tons in 1980.

Thereafter there was a period of recovery in catch rates and catch levels.

In the absence of sovereignty, and under occupation by South Africa, Namibia did not declare an Exclusive Fishing Zone under the International Law of the Sea, and international participation in the fishery continued between 1980 and 1990. Countries involved in the fishery included Poland, Japan, Spain, Russia, Bulgaria, Germany and South Africa. Nevertheless a measure of control was exerted by the International Commission for the Southeast Atlantic Fisheries (ICSEAF), a body set up by the FAO which was designed to permit South African participation (even though South Africa was excluded from the United Nations at that time, and hence by definition from the FAO). It was only in March 1990 that, upon attaining independence, Namibia was able to exert control over its coastal fisheries as a sovereign state. It did so in dramatic fashion, with at least five major policy steps:

1. The complete exclusion of foreign fishing fleets
2. The adoption of a radically conservative rebuilding strategy for the hake resource with an initial 70% reduction in the TAC from the last catch under ICSEAF in 1989.
3. An observer programme requiring Namibian (citizens) observers on board all vessels fishing in Namibian waters at all times.
4. The Namibianisation of the fishery, entailing allocations to companies with majority Namibian shareholding
5. Imposition of levies of between R400 and R800 per ton (R400 - Namibian flag vessels with at least 80% Namibian crew compliment, R 600 - Namibian flag vessels in general, R 800 - foreign flag vessels) equivalent to a significant proportion of the potential economic rent from the industry, with a rebate of R200 per ton if the fish was landed wet onshore for further processing. This variable levy structure is designed to promote the development of domestic shore-based processing of hake, and a predominantly Namibian crew compliment on fishing vessels.

The last two steps fall under the government's stated policy of the 'Namibianisation' of the industry designed to maximise employment of Namibians in the fishery, and to maximise the nations tax benefits from the resource. They also attempt to shift ownership of quotas to Namibian citizens.

The reduction in TAC levels in the Namibian hake fishery is one of the most ambitious modern day fishing experiments ever documented. It offers a major scientific opportunity to assess the veracity of modern quantitative stock assessment methods, since the surplus production model developed by scientists working under the aegis of ICSEAF suggests that under catch rates over the period, the resource should have recovered to very close to its pristine level by 1995.

Management and access control

The allocation of quotas (the hake fishery is controlled by an annual TAC and individual quotas allocated within the TAC, as in South Africa), motivated as it has been by the desire for 'Namibianisation', has resulted in allocations to:

1. Bona fide foreign companies in possession of productive assets, which have formed joint ventures with Namibian citizens in order to satisfy the 51% Namibian shareholding requirement.
2. Namibian companies with no productive assets.
3. Bona fide Namibian companies with productive assets.

However, this system is flawed because the government has allowed recognised companies with 51% or more Namibian shareholders to be classed as purely Namibian shareholders of another company. This means that although initially the Namibian interest in a fishing company might be 51%, it would be reduced to 25.5% when this company becomes a shareholder in another company. This process can go through a number of stages, effectively diluting the genuine Namibian shareholding in companies vying for quotas, but preserving the qualification of companies as wholly Namibian. This obviously allows for potential abuse of the share-holding criteria.

The variable levy structure is implemented with the following added qualifications:

1. Levies are paid up front at the beginning of the fishing season.
2. Uncaught quota is still subject to a levy, but this levy is hiked up to the highest levy rate (an incentive to catch quotas).

However, paper quota holders speculating with their fishing rights have at times tried to enhance the value of their rights by holding back on negotiating agreements with companies in possession of vessels and plant capable of landing and marketing the quota. When this is extended too late in the season it results in a shortfall in the TAC.

The levy structure has favoured the growth of a wet-fish fishing operations which require onshore processing, and this has boosted employment for Namibians, as has the levy incentive to employ a crew compliment consisting of 80% or more Namibian citizens. However, the allocations of quotas to Namibian companies with no productive assets (so called paper quotas) has presented the companies actually fishing for hake with the problem of having to negotiate joint ventures with 'paper quota' holders, in order to achieve volumes representing enough turnover to justify the use of the vessels that they own. This represents an additional levy on the industry of as much as R 1,000 per ton of fish.

The result of the above is that the profit/rent margins for hake fishing in Namibian waters is small relative to other hake fisheries. Company liquidation and sales are currently very common with a number of liquidation pending. The variability of catch rates in the Namibian hake fishery, combined with the small margins that are being achieved has exacerbated this situation. This is really testing the oft held view that profit margins in fishing have to be high to compensate investors for the risks they face, and that in the absence of these high profit incentives fishing enterprises can easily fail. Under the circumstances, it is still not clear whether the Namibian hake fishery will generate the medium to long term sustainable rents, employment and social benefits hoped for. The heavy capital investment in the industry, which is very new and typically dates back to independence, makes this situation more severe. Typical finance charges facing the average hake operator in Namibia are extremely high. The Namibian hake industry contrasts strongly with the Namibian pilchard industry in this regard which had processing capacity (e.g.

canning plants) prior to independence, and for which there was no financing overhead after independence.

These economic forces seem to be driving the industry in the direction of the high value Spanish fresh fish market. Under the circumstances it seems unlikely that the industry will develop the kind of high investment value added processing sector successfully pioneered in South Africa as a natural response to economic forces and opportunities. It is however possible that they could be coerced in this direction by new levy structures. The uncertainty of the fresh fish market makes the industry extremely vulnerable to one or two key markets, and susceptible to political pressure from that direction. Thus, although the government does seem to have achieved some of its goals in the short-term (i.e. tax and employment) it is not certain that this is a stable and secure base for the medium to long term and that the industry is able to maximise socio-economic benefits to the nation.

The government's management approach to the Namibian hake industry is an excellent example of overt taxation at source on an industry with a view to achieving certain socio-economic benefits and targets. The intended benefits are:

1. To maximise Namibian employment in the industry.
2. To derive tax benefits by levy rather than via the usual tax on profit approach adopted in conventional industrial situations.

The question one must ask is whether

A. The inhibition on investment and development of the industry which results from the application of the above two measures in combination with a very conservative harvesting strategy for the resource is leading to lasting taxation and employment benefits?

or

B. Whether moderate tax revenues are being achieved at the expense of a financially precariously balanced trawling industry which has not had the investment freedom and security to diversify and consolidate its position?

The indications at this stage are that the latter is the case. The one hope for the industry under these circumstance is to increase overall turnover either by escalating the level of concentration (typified by frequent liquidation and buy-outs, as seems to be happening at present - note that permanent quota transfers are only allowed if the entire company changes hands, portions of quota cannot be permanently sold - but portions of quotas can be temporarily transferred for harvesting purposes), or by substantially increasing the TAC. Paradoxically, but extremely fortunately for Namibia, there is a serious option for substantially increasing the TAC above the current level of 150,000 tons, closer to 250,000 tons, as was harvested during the last ten years prior to independence. This means that the burden for the economic success of the industry has shifted from sound management policies and economic planning to greater pressure on the resource.

The Moroccan fishery of European hake (*M. merluccius*)

(Chapter 4, A.. Martos and L. Peralta In *Hake Fisheries, Ecology And Markets*, Chapman And Hall Fish And Fisheries Series 15 Edited By Jurgen Alheit And Tony J Pitcher - 1995)

Overview

At present three nations, Morocco, Spain and Portugal, fish for the CECAF (Eastern Central Atlantic Fisheries) European hake. Fishing fleets are composed of artisanal coastal trawlers, trawlers/sardine-seiners and longliners, comprising a total of 540 vessels. A large proportion of the fleet is made up of small artisanal vessels (about 54 GRT) using small codend mesh size (40 mm) allowing them to fish for a mix of species (e.g. hake and deep water shrimp). These vessels

are too small to make fishing trips of more than four days and are not capable of fishing at depths greater than 200 m.

Although the European hake fishery in this region is relatively stable with catch rates at 10,000 tonnes a year, the resource is under protection to prevent overfishing and is fished well below its production potential. The size-specific depth distribution of European hake and the small mesh size that the vessels are using result in a fishery that is operating at very high effort levels, but production levels are low and product quality is not good. The MSY is estimated to be between 6,000 and 15,800 tonnes on the basis of the present mesh size, but could be considerably increased if gear selectively allowed for an increase in codend mesh size.

Management

Multiple species fisheries are difficult to control because fishermen deploy the same gear to fish for species which have very different biological characteristics. Small mesh sizes are required to catch shrimp, but these result in indiscriminate catches of juvenile hake. Currently there are attempts to establish a number of basic control measures including: limiting fishing effort by limiting total GRT; limiting the fishing activity of certain vessels to waters 12 miles or more from the coast; increasing codend mesh size (50 mm for all Spanish mixed trawlers and 60 mm for black hake trawlers); introducing a closed season for mixed trawling; and placing limitations on the percentage of bycatch.

Moroccan access to the hake resource is loosely controlled by the allocation of vessel licenses, and attempts made in the 1980s to reduce fishing effort in the shallow-water artisanal sector, resulted in a fall in the number of licensed vessels from 379 in 1979 to 172 in 1990. In 1984 Morocco forced Spanish trawlers operating in their waters to increase mesh size from 40 mm to 50 mm. This resulted in a notable effect on the size structure of hake caught by Spanish vessels. The Moroccan fleet however, which is primarily artisanal, could not cope with the inevitable short term reduction in catches of both hake and shrimp that would have resulted from using 50 mm mesh size, and still uses the 40 mm codend mesh size. The inability to endure, even on a temporarily basis, the economic implications of more restricted fishing regulations is a characteristic of many artisanal fisheries.

The North-east Atlantic European hake fishery (*M. merluccius*)

(Chapter 5, J. Casey and J. Pereiro In Hake Fisheries, Ecology And Markets, Chapman And Hall Fish And Fisheries Series 15 Edited By Jurgen Alheit And Tony J Pitcher - 1995)

Overview

The European hake fishery started as an artisanal line fishery in the mid 1700's and remained as such until the introduction of the otter trawl during the mid 1800's, when catches from line fishing began to fall. The resource is spread over a wide area between the coast of Mauritania and the western coast of Norway, and is exploited along the entire western European shelf from the Straits of Gibraltar in the south to the Shetland Isles in the north. Catches peaked in the mid 1940's at 175,000 tonnes a year but declined sharply to about 115,000 tonnes a year by 1950, before stabilising over the next 20 years. Following the declaration of 200 mile zones catches further declined and are now stable at about 80,000 tonnes a year.

From a stock assessment point of view, the European hake has been divided into two: the Southern stock and the Northern stock. This division is largely an arbitrary one based on geographical borders created by the Cape Breton Canyon which separates Spanish and French waters, and on some different biological characteristics of the two stocks. The Northern hake stock is mainly caught in mixed fisheries along with other demersal species. Otter trawling and longlining are the

main methods of fishing, and constitute 69% and 25% of total catches respectively. There is also a small amount of gill-net fishing. Catches of the Southern stock are made by otter trawls (44%), a variety of artisanal fishing methods such as small longliners, handlines and small mesh gill nets (19%), large longliners (18%), and large mesh gill nets (19%).

Management

Both the Northern and Southern stocks are managed by the setting TAC's, minimum landing size regulations and minimum mesh size restrictions. Both stocks are spread across a number of territorial borders and are fished by a large number of vessels deploying many different types of fishing equipment. As a result both stocks are believed to be under severe overexploitation. In the Northern stock, a 30% reduction in fishing mortality is thought to be necessary in order to achieve the biomass that would produce the MSY (B_{msy}). There are high catch rates of small hake, and 40% of Northern hake landed (about 60 million fish) are below the 27 cm legal size, and a further 30 million young fish are dumped at sea each year.

The Southern stocks are in an even worse condition with a 40% reduction in fishing mortality necessary to rebuild the resource to its B_{msy} level. 38% of landed fish are smaller than the 24 cm legal size and there is also considerable dumping of fish in this fishery. At present scientists believe that the resource is well below its B_{msy} and that Southern stocks are still declining. A variety of control measures are presently being discussed, including an increase in mesh size to 80 mm and a legal fish length of 30 cm in the North, and a mesh size of 65 mm and fish size of 24 cm in the South.

The need for agreements between a number of nations and the need to accommodate a large number of fishing methods are obviously hampering a coherent management plan, but it is also notable that the declining Southern stocks (with a smaller mesh size and smaller legal fish length) has a large artisanal component. This sector exhibits vulnerability to the short term effects of reductions in fishing mortality through the imposition of smaller TAC's or through increased gear selectivity, and the result is economic and social pressure to overexploit the resource.

The Western Mediterranean hake (*M. merluccius*))

(Chapter 7, P. Oliver and E. Massuti In Hake Fisheries, Ecology And Markets, Chapman And Hall Fish And Fisheries Series 15 Edited By Jurgen Alheit And Tony J Pitcher - 1995)

General overview

Most fishing of western Mediterranean hake is carried out by trawlers on muddy and sandy bottoms between 30 m and 700 m. Spanish trawlers also operate at depths of 100-200 m, and French ones in waters of 30-300 m. The agreed legal mesh size is 40 mm but this rule is generally ignored by coastal fishermen. The fishery is a multispecies one, and although hake is one of the main target species, there are a number of other commercially important demersal and pelagic species. About 2,600 trawlers fish for the western Mediterranean hake: 1,230 in Spain, 851 in Italy, 294 in Algeria, 207 in France, 78 in Morocco and a small but an unknown number in Tunisia. These trawlers are largely artisanal or semi-industrial with an average GRT of 40 tonnes, and present annual catches are around 16,000 tonnes. There is also some longlining and gill netting for hake.

Management

Management of hake stocks in the western Mediterranean is hampered by the multispecies nature of the fishery and by multiple gear use. As a result, management approaches to the hake resource inevitably effect other target species. This is particularly critical with regard to the imposition of a larger mesh size but is also important with respect to overall fishing mortality. The theoretical

need to halve fishing effort and to substantially increase codend mesh size are not practical options, as the socio-economic consequences of such steps are unbearable to the majority of fishermen.

The North-West Atlantic hake fishery (*Silver hake* - *M. bilinearis*)

(Chapter 8, T. Helser, F. Almeida, and D. Waldron In Hake Fisheries, Ecology And Markets, Chapman And Hall Fish And Fisheries Series 15 Edited By Jurgen Alheit And Tony J Pitcher - 1995)

Overview

This resource stretches along the north-eastern continental shelf of North America. Until 1960 the silver hake, one of the most abundant demersal fish in the region, was exploited exclusively by American fleets. Before 1919 landings never exceeded 3,000 tonnes as fishermen did not value the fish highly, and the fishery was primarily an inshore one using pound nets and traps with a small recreational element. The real development of this fishery started during the 1940s with the introduction of otter trawlers. By 1950 US annual catches had risen to 45,400 tonnes with most of the catches being reduced to fish meal and fertilisers. Catches peaked in 1957 when they reached 78,000 tonnes, but then declined so that by 1972 catches stood at only 12,000 tonnes.

At the same time foreign fleets from USSR, Bulgaria, Cuba, Germany (Eastern), France, Italy, Japan, Poland, Romania and Spain began to exploit the fishery. Landings of silver hake by foreign fleets increased from 41,900 tonnes in 1962 to 299,000 tonnes in 1965 making the total catch for this year a historic record of 351,000 tonnes. The subsequent decline in catches near the American coastline in the late 1960's drove the majority of the foreign fleets to move to more distant waters around the Scotian shelf and the southern Georges bank, where catches reached 299,000 tonnes in 1973. The foreign fleets deployed very large vessels of between 1,000 and 3,000 GRT, while US and Canadian vessels were much smaller at about 300 GRT. From 1973 fishing by foreign fleets was considerably restricted to small areas and short seasons, and foreign fishing effort dropped considerably as a result with many vessels leaving the area. However, following the withdrawal of foreign fleets American fishing effort and technology intensified such that fishing effort increased by as much as 100% in the following years. As a result the silver hake resource was not given an opportunity to recover, and catches fell until stabilising at about 17,000 tonnes, which continues to be the average US catch of silver hake today.

From 1977 Canada assumed management control over the Scotian Shelf fishery. Catches peaked at around 91,000 tonnes in 1989 but have since stabilised at around 70,000 tonnes a year.

Although Canada reduced catch allocations to foreign fleets from 1977, local companies formed joint ventures with Russian and Cuban vessels, and fishing effort at present is similar to the 1977 level.

Management

Since 1977 Canada and USA have deployed different bodies to manage the silver hake resource. In Canada the Canadian Foreign Fishing Regulations and Fisheries Act is now used as a management guideline and includes a codend mesh size of 60 mm, closed seasons, closed areas, and an overall reduction in fishing effort. Although there are no management regulations which are specific to the American silver hake resource, general guidelines were drafted by the US Magnuson Fishery Conservation and Management Act, which covers all fishing in the north west Atlantic. This act, which aimed to restore all resources to a position of optimum yield, used silver hake fishing as a buffer to other overexploited groundfish (e.g. cod, haddock and yellowtail flounder). Fishing mortality is currently close to a definition of overfishing, and all sectors of the resource are considered to be fully exploited with no potential for expansion of the fishery and with a poor short term prognosis for the stock.

The Argentine hake fishery (*M. hubbsi* and *M. australis*)

(Chapter 9, S. Bezzi, G. Verazay and C. Date In *Hake Fisheries, Ecology And Markets, Chapman And Hall Fish And Fisheries Series 15 Edited By Jurgen Alheit And Tony J Pitcher - 1995*)

Overview

The Argentine hake industry can be divided into two main sectors: coastal and offshore fleets. The coastal fleet is composed of a large number of small trawlers (20-100 GRT) which only catch hake close to the shore. The offshore fleet has about 165 large vessels of 300-1,500 GRT catching hake and squid, with onboard freezing and factory facilities. The offshore industrial fleet developed in the early 1950's, and from 1976, Argentine companies formed joint ventures with Spanish firms with large factory ships, and catches of hake reached 370,000 tonnes in 1979. This was followed by a gradual decline in catches to 183,200 tonnes in 1984 with catches then increasing again to 314,200 tonnes in 1987.

Management

The Argentinean hake industry is now mostly industrial. Fishing regulations do not allow hake catches for fish meal, fishing is not allowed on recognised spawning grounds, and codend mesh size is set at 120 mm. The Uruguayan hake fishery which developed along similar lines as the Argentinean one but on smaller scale, also has similar regulations and the management of the resource between the two nations is well co-ordinated. The industry in general is controlled by a relatively small number of companies and directly employs over 9,000 people.

The Chilean Hake fishery (*M. gayi*) and (*M. australis*))

(Chapter 11, M. Aguayo-Hernandez In *Hake Fisheries, Ecology And Markets, Chapman And Hall Fish And Fisheries Series 15 Edited By Jurgen Alheit And Tony J Pitcher - 1995*)

Overview (*M. gayi*)

The fishery for *M. gayi* began in 1940. In the early 1940s landings fluctuated around 9,000 tonnes, and over the next 10 years increased gradually to peak in 1955 at 76,000 tonnes. Subsequently catches fluctuated greatly, and probably as a result an expansion of effort and improved technology rather than resource abundance, peaked again in 1969 at 130,000 tonnes. Catches then declined rapidly until they stabilised at around 30,000 tonnes in 1976. Since 1988 there has been a marked increase in catches to over 50,000 tonnes, associated with an increase in average body size indicating some recovery in the resource. The fishery has an industrial sector of 23 stern trawlers and 4 side trawlers of between 40 and 981 GRT, and an artisanal sector of over 1,000 boats using longlines. Of the 53,000 tonnes landed in 1990, industrial catches were 44,600 tonnes with the artisanal fishery contributing only 8,400 tonnes.

Overview (*M. australis*)

The Chilean austral demersal fishery started in 1976 with the operation of a single Japanese factory trawler. At present five fishing fleets fish for the *M. australis*: four are industrial, made of two refrigerating fleets and two factory fleets (trawlers and longliners; 50 to 5000 GRT). The artisanal fleet is made of small vessels between 6m to 18 m in length of less than 18 GRT. During the late 1980's there was a large increase in the number of longliners while the size of the trawl

fleets remained fairly stable. Catches and CPUE started to drop drastically from around 70,000 tonnes in 1988 to less than 50,000 tonnes in 1990, with an average drop in CPUE for the different fleets of 70% (with the exception of refrigerating longliners where the drop in CPUE was moderate). The artisanal catches dropped during this period from about 28,000 tonnes to less than 15,000 tonnes, while industrial catches fell from 37,000 tonnes to about 30,000 tonnes. Mean fish size also dropped sharply between 1981 and 1990, and was attributed principally to the development of artisanal and longlining fishery from 1984. Fish mean size also dropped when trawling effort moved into shallower water between 1986 to 1990.

Management

The Chilean hake resource seems to be under increasing pressure and steadily declining. The expansion of the artisanal sector and longlining created a serious control problem and fishing regulations were inadequate to regulate fishing activities in the inshore zone up to 1989. This problem is not a short term one and is unlikely to be solved in the near future. Management rules include TAC's for inshore and offshore resources, and area and seasonal restrictions.

A new Fishing Law was approved by Congress in September 1991. It modifies core aspects of Chilean fisheries management. The new law recognises three basic access regimes to national fisheries:

- i) General
- ii) Fully exploited
- iii) ITQ fisheries, which are divided into those that are Recovering fisheries, and those that are Newly developed fisheries. A recovering fishery is defined as one which has experienced overexploitation in the past and has been subjected to a fishing moratorium for at least three years, for purposes of rebuilding the stock, and for which it is possible to establish a scientifically defensible TAC.

It appears that the intention of the new law is to use the proportional ITQ mechanism to allocate "new" TAC opportunities offered by fisheries which are recovering and by those that are new (but not for general and fully exploited fisheries!). If the fishery belongs to the category "Recovering fishery", then the state calls for the auctioning of Extraordinary Fishing Permits or Licenses.

These licenses may be divided, transferred, transmitted, sold and rented.

In the first year, the state auctions off 100% of the TAC to "first time buyers". However, in each subsequent year, the first time buyers have to surrender 10% of their TAC to the state, so that after 10 years, the first time buyers in principle have no quota. However, the 10% of the TAC that is surrendered to the state each year is offered for public auction in the same year, giving the first time buyer the opportunity to repurchase quota, and thereby maintain their quota holding. In tandem with this state managed process of allocation, quota holders are free to buy and sell quotas on the free market. There is a 50% anti-monopoly ceiling on quota holdings. If a license is not used within two years, it becomes extinct.

In the case of fully exploited resources, fishing rights are transferable with the vessel, or may be transferred from one vessel to a new vessel with the same owner. The government may auction off a percentage of the TAC (5%) annually, up to a maximum of 50% of the total TAC. These auctioned rights may be transferred, transmitted or divided. These rights have a fixed time period of 10 years and they cannot be rented.

The Peruvian hake fishery (*M. gayi peruanus*)

(Chapter 12, M. Espino, R. Castillo and F. Fernandez In Hake Fisheries, Ecology And Markets, Chapman And Hall Fish And Fisheries Series 15 Edited By Jurgen Alheit And Tony J Pitcher - 1995)

Overview

The Peruvian demersal fishery developed in the early 1970s following the collapse of the pelagic anchovy and sardine fishery. The hake fishery was initiated in 1973 by allowing large demersal trawlers from Poland, Cuba, Spain and Japan to fish in Peruvian waters. Catches fluctuated between 85,000 tonnes and 132,000 tonnes during 1973-1977, before reaching a record high of 300,000 tonnes in 1978. Since then annual catches have fluctuated enormously between 5,800 and 127,200 tonnes with an annual average of about 58,000 tonnes. The estimated resource MSY is between 100,000 and 150,000 tonnes a year.

Management

Most of the hake fishing fleet is based in the port of Paita and is in need of considerable modernisation. Operational limits of factory trawlers are specified, with foreign factory trawlers prohibited from operating north of 6° S while domestic ones may do so along the whole Peruvian coastline. Large factory trawlers (> 150 GRT) have no right to fish within 30 miles of the coast, and those using bottom trawls must fish in depths of more than 200 m, while midwater trawlers are limited to depths of over 100 m. Mesh size is set at 90 mm and the minimum legal landing size is 35 cm. A process of stock rehabilitation and fleet modernisation is underway, and it is likely that the hake fishery may soon recover to produce 100,000-150,000 tonnes a year.

The New Zealand hake fishery (*M. australis*)

(Chapter 13, J. Colman In *Hake Fisheries, Ecology And Markets*, Chapman And Hall Fish And Fisheries Series 15 Edited By Jurgen Alheit And Tony J Pitcher - 1995)

Overview

The New Zealand hake is a deep water fish (500m to 900 m) and most catches are taken as a bycatch of the much larger hoki (*Macruronus novaezelandiae*) trawl fishery. The hake fishery in New Zealand is relatively small and catches now stand at around 9,000 tonnes, after a peak of 19,400 tonnes in 1977. The Hoki/hake fishery is exclusively targeted by large trawlers. Until 1978 there was no control on fishing but since then gradual restrictions have been set on the operation of foreign fleets unless they operate under control and management of New Zealander share-holders. As a result, foreign licensed trawlers have gradually disappeared from the fishery. At present the hoki/hake fishery is fully industrialised with large factory trawlers capable of fishing in deep sub-Antarctic waters and processing fish on board.

Management

The present management system is based on individual transferable quotas (ITQ's) in each of the 10 management areas, with quotas expressed as a proportion of the TAC. The hake fishery has been divided into three main management areas. The estimates of hake stocks in each management area are assessed together with other fish stocks by fisheries scientists from the Ministry of Agriculture and Fisheries (MAF). These assessments are discussed within working groups comprising the fisheries scientists, representatives of the fishing industry, recreational fishing groups, Maori interests and environmental groups. Recommendations from these working groups are then discussed by the Total Allowable Commercial Catch Council which includes policy makers, industry representatives and fishery scientists. The TACCC makes recommendations to the Minister of Fisheries who is responsible for setting the TAC's for the next fishing year. Although each management area is allocated an annual TAC, fishing operators are allowed to catch hake in excess of their quotas in order to allow them to fulfil their hoki quota. However, any excess hake are surrendered to the MAF and then bought back by quota holders at a price agreed between the Ministry and the industry. The main outcome of the measure which was introduced

in 1988 was a sudden increase in reporting of hake catches which were previously under-reported to protect hoki quotas.

The US North Pacific hake fishery (*M. productus*)

(Chapter 14, R. Methot and M. Dorn In *Hake Fisheries, Ecology And Markets*, Chapman And Hall Fish And Fisheries Series 15 Edited By Jurgen Alheit And Tony J Pitcher - 1995)

Overview

The Pacific hake, also known as Pacific whiting, is the most abundant commercial fish species off the US coast of California, Oregon, Washington and the southern part of British Columbia, with total annual catches of about 300,000 tonnes. Prior to 1966 only a small coastal fishery existed with annual catches of a few hundred tonnes. At this time most catches were reduced to pet food and fertilisers. The fishery developed rapidly when large foreign trawlers started to fish the deeper waters in 1966. The main contribution of large trawlers, in addition to their fishing capabilities, was their ability to maintain high quality product thus opening up the market for hake for human consumption. Foreign fishing effort was directed through joint-venture companies in the early 1980s until the US fleet had grown to a sufficient level to harvest the entire quota, by which time foreign effort had been phased out. In connection with the development of the domestic fleet was the rapid expansion of onshore processing capacity.

Management

The at-sea US hake Pacific fishery is monitored by on-board observers trained by the National Marine Fisheries Service (NMFS). Management policy is drafted by the US Pacific Fishery Management Council (PFMC) and approved and implemented by the NMFS. The PFMC meets four or five times a year for development, public comment, revision and final recommendation of fishery regulations. The primary fisheries control is the setting of annual TAC's together with the Canadian authorities. However in recent years due to lack of agreement between Canada and USA, the sum of quotas has exceeded the global TAC by 28%. Other regulations control gear (codend mesh size is set at 75 mm), area, and season, primarily in response to bycatch concerns. The main conflict with regard to the allocation of fishing rights is the allocation between onshore and at-sea processors. This developed when at-sea processors began to view the hake resource as a good substitute for reduced opportunities in Alaska, particularly for pollock. Although some biological factors have been introduced into the debate, the main issue has been an economic and social one. Net benefit analysis was complicated by the volatility of the surimi markets and by the relative newness of the high-volume onshore hake production. Other issues in the debate were fish waste utilisation, employment opportunities in coastal communities and the geographic distribution of economic benefits. In 1992 a temporary formula was created which divided the resource between vessels delivering to onshore processors (approximately 30%) and at-sea processors (70%). An attempt to develop a longer term allocation policy which gives a base amount to onshore and increasing amounts to at-sea processors when the total quota is large, was not approved.

Conclusions

In conclusion, the brief review above suggests three general patterns in the development of hake fisheries around the world.

1) The artisanal multispecies fishery - North-West Africa, Eastern Mediterranean, Western Mediterranean

These fisheries are characterised by being multispecies, multigear fisheries, fished by artisanal or small industrial fleets. The contributions of these fisheries to world catches is minimal, and small catches per capita are utilised for own consumption or destined for local markets. The fish caught tend to be small because of the multipurpose fishing gear used, and are of a poor quality due to the lack of sophisticated processing and storage facilities. These fisheries operate under severe growth and recruitment overfishing, with very little prospect for improvement in the future due the reliance of fishermen on daily catches for survival which prevents the implementation of a rebuilding harvesting strategy. Management is generally aimed at basic gear and area restrictions, and at containing fishing effort. The national economic rent from these fisheries is very small and although they employ a large number of people, most of the people they support remain poor with little potential for economic empowerment. Small-scale fishing activities serve to maintain poverty while restricting options for a sophisticated, productive and well controlled demersal fishery, from which benefits could be redirected to communities in need.

2) The industrial multispecies fishery - North-east Atlantic fishery, North-West Atlantic, North Pacific, Chile

These are fully established commercial fisheries which have a large industrial sector as well as a strong artisanal one. These fisheries are fully exploited or overexploited and now produce well below their maximum production level. The main problem in managing these fisheries has been the large number of participants and the multispecies nature of fish harvesting. This makes target management of hake difficult, as catches are allowed to exceed recommended TAC's in order to compensate for reduced catches of other demersal species or as bycatch to prevent losses of catch in main target species. The overall approach to the management of these fisheries however is commercial, and as knowledge of resource dynamics and international co-operation increases, joint management objectives can be set in order to conserve the resource and to increase long term productivity.

3) The targeted industrial hake fishery - South Africa, Argentina, Namibia, Peru, New Zealand
 These fisheries have a large industrial sector with a small or non-existent artisanal sector. They are fully developed industries which produce high quality product for human consumption, and the national economic benefit from these fisheries is high. With the possible exception of the New Zealand hake fishery (which is very small), fishing is targeted on hake and management of the resource is thus focused and largely effective. Where the resource is shared by only one or two countries, tighter control and enforcement is considerably easier. These fisheries, although overfished in the past, now appear to be fairly healthy with good prospects for further recovery because fishing regulations are tightly followed and catches are often below the estimated sustainable yield. The main threat facing these industries is a growing demand for further expansion of the artisanal sector.

The Icelandic And New Zealand ITQ Systems

(The Icelandic Fisheries - Evolution and Management of a Fishing Industry, R. Arnason, 1995: Fishing Rights And Fishing Policy: The Development Of Property Rights As Instruments Of Fisheries Management, P. Pearse: New Zealand's ITQ system for Fisheries Management, I. Clark, 1991)

Overview - Iceland

Most of Iceland's commercially important fish stocks reside within the 200 mile zone between 50 and 200 miles offshore, with the exception of the deep sea redfish, which is found up to 350 miles from the coast. Between 1980 and 1992 foreign catches only amounted to about 2% of demersal catches, and total average catches between 1980 to 1992 were 1.4 million tonnes, with the demersal sector (mostly cod, haddock, saithe and redfish) contributing almost 50%. The remaining 50% of the total catch was a variety of pelagic, crustaceans and shellfish species.

Until the beginning of the 20th century the Icelandic fishery was a primitive one operating on a subsistence basis as a part-time activity to supplement farming. Fishing was done in open rowing boats and annual catches were about 10,000 tonnes. The introduction of deck sailing smacks in the early 1900's resulted in a considerable increase in the geographical range of vessels and in the duration of the fishing season, and the introduction of the longline increased fishing vessel productivity. During the 1930s, 40 steam trawlers and 100 motor boats completely replaced the sailing smacks and rowing boats and this resulted in a sharp decline in the use of longlines, particularly handlines. In 1930 the freezing fleet also emerged and became the most important component of the fish processing industry and has remained so ever since.

In 1946-49 the government, through its Renewal Plan, made financial capital available to the fishing industry on favourable terms for investment in fishing vessels and fish processing plants. The result was 40 new deep-sea trawlers, 50 smaller multipurpose fishing vessels, 5 new freezing plants and 12 reduction plants. In 1971 another investment programme was initiated by the government to rebuild the Icelandic fishing industry using up-to-date technology. In particular, the government encouraged investment in deep-sea stern trawlers and improvements to freezing plants, while investment in regional fishing industries enjoyed special support, and catches increased significantly as a result of this initiative. Deep-sea stern trawlers stabilised supply and increased the quality of landings. In 1992 28 freezing trawlers caught 120,000 tonnes of demersal species, which amounted to 25% of the total demersal catch. A result of the aggressive investment program over the years however has been overfishing and overcapitalisation of the industry. Demersal resources have been badly depleted, and the overcapitalised and fragmented fishing industry maintains high fishing pressure with biologically and economically undesirable fishing mortality.

The estimated MSY for the demersal sector is currently estimated at 720,000 tonnes which is about 10% higher than annual average catches. The problem however is that the demersal stock is badly depleted and demersal stocks in general have not been allowed to recover. The cod stock for example is currently at about 30% of the B_{msy} with fishing mortality 3-4 times the optimum level.

Management - Iceland

Until 1984 when the vessel quota system was introduced, access to fisheries was not controlled. Fishing firms found themselves in a position where the optimal strategy was to expand operations, invest capital and expand effort to a point far in excess of the biological productivity of the fish stocks. Before the declaration of the 200 exclusive fishing zone in 1976, effective management of the fisheries, especially the demersal fisheries, was impractical due to the presence of large foreign fleets. Management measures consisted mainly of protecting juvenile fish in accordance with international agreements on minimum allowable mesh size, but these agreements were widely ignored by foreign vessels. Following the 1976 declaration, a process was started to bring all Icelandic fisheries under tight biological and economic management control. By 1984 all Icelandic fisheries had been placed under extensive management restrictions.

In 1976, cod (the most important demersal fishery) was subjected to an overall catch quota, although this was found difficult to enforce due to the large number of quota holders and continuous pressure from fishermen to increase their catches. In 1977, individual effort restrictions were introduced by limiting the number of allowable fishing days for each vessel. As the demersal fleet continued to grow, the number of annual allowable fishing days had to be reduced year by year. While 323 fishing days per vessel had been allowed in 1977, by 1981 only 215 fishing days were permitted. This system proved to be economically and biologically inefficient, and in 1984 individual vessel quotas were introduced. In 1990 a complete vessel quota system was introduced through "The Fisheries Management Act", which limited effort and catches in demersal and other fisheries, and fisheries management in Iceland is now largely based on Individual Transferable Quotas (ITQ).

Management measures include overall catch quotas, fishery access licences, individual vessel effort restrictions, individual processing plant quotas, and individual vessel catch quotas. These vessel catch quotas represent shares in the TAC, are permanent, perfectly divisible and freely transferable. The Ministry of Fisheries determines the TAC for all the important species in the fishery. The TAC is set on the basis of recommendations from the Marine Research Institute, but is also influenced by the cod industry which plays a substantial role in the Icelandic economy.

Basic principles of the Icelandic ITQ system

1. TAC shares - Each eligible vessel is issued a permanent share in the TAC for every TAC species. The holder of TAC shares must harvest at least 50% of their TAC share every second year to retain the share.
2. Initial allocation of permanent quota shares - In the demersal industry the TAC shares are normally based on the vessel's historical catch record during certain base years, which usually equal the vessel's average share of the total catch during the 3 years prior to the introduction of the vessel quota system in 1984.
3. Annual vessel quota - The size of each vessel's annual absolute quota in a specific fishery is a factor of the TAC for that fishery and the vessel's TAC share.
4. Divisibility and transferability - Any fraction of a given quota may be transferred. TAC shares are transferable without any restrictions, and the same applies to transferral of annual quotas, provided they are transferred within the same geographical region. Transfers of annual quotas between regions are subject to revision by fishermen's unions and local authorities.
5. Restricted access: licences - In addition to the ITQ system, Icelandic fisheries are subject to restricted access through the licensing system whereby all commercial fishing vessels must hold valid fishing licences. These are issued only to vessels which were already active in the fishery in 1990, or to replacements to vessels leaving the fishery provided they are comparable in terms of fishing power. The licences are not transferable.
6. Flexibility of the ITQ system - The system allows for a good deal of flexibility in the individual quota constraint each year. Current rules allow a quota holder to exceed his annual quota for each species by 5%, subject to a corresponding reduction in his quota for the following year. Quota holders are also allowed to postpone the harvesting of up to 20% of their annual quota until the following year, and it is permitted to switch up to 5% of the annual quota (in value terms) from one species to another.
7. Quota fees - In order to cover the cost of monitoring and enforcing the ITQ regulations, a levy is raised on vessels of 0.4% of the estimated catch value.

The Performance of the Icelandic ITQ System in demersal fisheries

The crucial factor in assessing the impact of the vessel quota system is the difference between the actual fishing effort during 1984 and 1990 compared to the fishing effort level that would have prevailed during the period had the vessel quota system not been introduced. A simplistic model to explain fishing effort under the two different management regimes has been employed, and the estimated growth rate of 2% in fishing effort under the vessel catch quota system is considerably lower than the 6% estimated under the effort quota system. According to these estimates, the vessel quota system has reduced total demersal fishing effort by some 30% when compared with the fishing effort that would have been expected under the previous management system. Under the vessel quota system, competition between vessels for a limited stock of fish was eliminated and fishing firms could only increase revenues by improving the quality of their catch. No detectable increase in discards was observed following the introduction of the vessel quota system in 1984.

Overview - New Zealand

New Zealand's 200 mile EEZ is some 1.3 million square nautical miles. While the zone is very large, it is not, by world fishery standards, very productive having only a narrow continental shelf with 72% of the zone having water deeper than 100 metres. It is estimated that there is an available fishing resource of some 700,000 tonnes of which a little under 600,000 tonnes is subject to the Quota Management System (QMS). The domestic market for fish products has remained relatively static over recent years, and 80% of total production is exported.

Prior to the declaration of the EEZ in 1978, fisheries were small and confined to an inshore domestic industry operating to a depth of around 200 metres. What little management that existed was confused and access was open to all. Investment was encouraged through capital grants, allowances and tax breaks, and the expansion of the domestic industry laid the foundations for its further development into the deepwater fishery following the declaration of the 200 mile zone. By the early 1980's New Zealand's policy of open-access to its fisheries had led to the usual problem of overexpanded fleets, depressed stocks and low incomes in the inshore fisheries. It was realised that economic and biological objectives were needed to achieve more effective fisheries management.

Management - New Zealand

In 1983, in an unprecedented stroke of policy reform, New Zealand adopted a system of ITQ's. Under the system, the TAC in each fishery, defined by species and area, was initially distributed among the fishermen as ITQ's, based on their investment and recent catch histories. Since 1990 each quota is expressed as a percentage of the TAC for the fishery, which the fisheries authorities adjust from year to year. Negotiations over the move to proportional quotas in 1990, partly as a method of incorporating Maori claims to part of the resource, involved negotiations by the government with the New Zealand fishing industry. These negotiations resulted in the Fisheries Amendment Act which provides that TAC reductions are to be compensated for at agreed values. Quotas are issued in perpetuity, and are divisible and transferable with few restrictions.

Harvesting rights in each fishery can be bought and sold on an open market, and prices and related information are readily available through brokers. The licensing system is very adventurous in allowing unfettered market processes to allocate the catch, to establish the value of fishing rights and to rationalise fishing fleets. Trade in quotas is unrestricted, provided only that quota-holders are citizens of New Zealand and none holds more than the permitted maximum share (usually 20% in inshore fisheries) of the total allowable catch in a fishery.

The regime has already improved the economic performance of the fishing industry, and with each fisherman's catch limited by his quota, it has been possible to relax many restrictions such as closed seasons and restrictions on fishing gear. Additional gains in efficiency have occurred with rationalisation of the industry. Regulatory and enforcement effort has shifted from policing fishermen on the fishing grounds, to monitoring landings and reconciling them with the quota holdings of fishermen. Landings information from catch returns provide detailed information to assist in the scientific stock assessment program. The government collects resource rent through the initial sale and leasing of quotas and by levying annual rentals on allocated quotas. As the profitability of fishing has improved, so resource rents have risen.

A recent independent review of New Zealand's fisheries policy reported that "the quota system can be credited with improving the management of stocks, reducing redundant fishing capacity, alleviating conflicts over allocation of catches, substantially improving the economic returns from fishing to both the fishing industry and the Government, and reducing pressures on fisheries managers" (Pearse 1991).

Importantly, the system is also strongly supported by the fishermen and fishing companies, non-commercial fishing organisations and regulatory bodies, and early problems associated with by-catches, monitoring, and the determination of rental charges appear to be being resolved.

Conclusions

Prior to the imposition of ITQ's in both Iceland and New Zealand, chronic overcapitalisation and severe overfishing occurred as a result of poor fisheries management and a lack of adequate access control. Both countries have benefited from the ITQ system.

Of course there are problems associated with the implementation of ITQ's, particularly over the initial distribution of shares. This is not important in itself for the policy maker as transferability results in a redistribution, but problems do result from the concern of fishermen about their initial shares and the value of their allocations, and are thus political in nature. Once established however, ITQ's have proved to be have been popular with fishermen, which is an important step in itself in achieving a successful and enforceable system of fisheries management.

The ITQ fisheries system in both Iceland and New Zealand has been the subject of intense debate and almost continual revision. The debate is focused around two main issues:

1. The equity aspects of the ITQ system. Why should a relatively small group of fishing firms and their owners be handed, more or less free of charge, the valuable property rights to the fishery? This debate, fuelled by continually increasing quota values in the market place, is concerned with the distribution of the fisheries rent and not so much with the fisheries management system as such. Critics of the system seek to impose taxes on quota use or to facilitate a reallocation TAC shares on a more equitable basis.
2. The regional implications of the ITQ system. Discussion on this issue centres around restricting the transferability of quotas rather than dropping the ITQ system altogether

It is difficult to predict the outcome of these debates. The ITQ system is well entrenched and its economic benefits so obvious that it appears extremely unlikely that it will be abolished. It may however be modified, and it is probable that the ITQ system will continue with part of the resource rents generated by the system being expropriated by special taxation.

The ITQ system in Iceland has been shown to have protected stocks (although there is still potential to increase stock biomass) and to have improved economic efficiency, thereby contributing to the economic and social development of the country as a whole. In Iceland approximately 75% of fish products are currently exported, and the fishing industry now contributes 45% to the GDP, with 15% directly from fisheries and another 30% from satellite industries and other economic activities linked to, or dependent on, the fishing industry (e.g. maintenance of vessels, plant and equipment construction, shipbuilding, manufacture of fishing gear and processing machinery etc.). The ITQ system in New Zealand has also improved the economic efficiency of the fishing industry following a period of overfishing and overcapitalisation in the fishery.

The ITQ system in these countries shows how fisheries management can ensure the long term sustainability of the resource in such a way as to maximise the economic benefits to the nation. Fisheries can then be used as method of contributing resource rents to the country as a whole, thereby assisting in improving macro-economic and social conditions.

Coastal Fisheries Management In Japan

(FAO Fisheries report no 474 on the Development of Community-Based Coastal Fishery Management Systems for Asia and the Pacific, 1992: Fishery Management in Japan, FAO Technical Paper 238, Y. Asada et al, 1992: Japanese Fisheries Agency Report, 1995)

Overview

Marine resources have historically been the main source of animal protein in Japan. Prior to the early 1700's fishing was only a side business for farmers in areas where options for rice farming were limited. The rapid increase in population in the 17th century initiated the development of an artisanal fishing industry in the coastal villages. At this stage fishing grounds were the property of the provincial feudal lords and were a source of constant dispute between the hundreds of fishing communities throughout Japan. In 1868 the feudal provincial system was formally terminated, but

old fishing arrangements still existed. Between 1875 and 1886 a complex set of rules regarding fishing rights was created to form what later become the Japanese fishery law. In 1902 the Fisheries Law was enacted, and following a revision in 1910, remains the foundation of the fishing rights and licensing system of today.

In the late 1800's the introduction of powered vessels made access to new offshore fishing grounds possible. This was followed by a dramatic increase in catches and in the number of vessels and fishermen, but the number of trawl nets and seines being operated from non-powered vessels declined rapidly. Nevertheless, small-scale subsistence coastal fisheries still exist all over Japan sustaining impoverished coastal communities.

Fisheries provide the main source of income for the coastal fishing communities which comprises 180,000 fishing households, about 300,000 people (fishermen and fishing industry members) and 270,000 fishing boats, and consumption of marine products in Japan is large in terms of both quantity and diversity. The new Fisheries Law introduced after World War II restricted the activities of fish wholesalers who were beginning to monopolise the fishing industry, and attempted to favour coastal fishermen while promoting a well-planned, comprehensive use of the sea. Many fishermen were organised into fisheries co-operatives under the Fisheries Co-operative Association Law of 1948, in order to provide jurisdiction over fishing grounds where members of these co-operatives operated. Fishermen's groups were given priority in licensing rights for set-net fisheries. These regulations, which were implemented in 1949, are still valid today and fisheries co-operatives remain at the centre of coastal fisheries management in Japan. Fishing rights are always granted to co-operatives in preference to other fishermen operating on the same fishing grounds. The co-operatives implement the management of the fishing rights and carry out fishermen's training. They are also involved in management of some of the offshore areas but do not impinge on the jurisdiction of national and prefectural government.

Co-operative management deals with four main issues:

1. Control of fishing activity by rotating fishing between all fishermen so that only a limited number of vessels operate at any one time and by assigning certain boats to fish for everybody. This system prevents too many boats operating in certain grounds, but results in a huge surplus of fishing effort in the fishery.
2. Price fixing through restrictions on catches, in order to prevent prices from dropping as a result of an over supply of fish. This is normally done by setting daily quotas according to vessel size or the number of owners, and/or by a "two day fishing and one day rest" system.
3. Resource conservation through the enforcement of regulations.
4. Expansion of resources through enhancement of fishing grounds and the promotion of restocking.

Management

Fishing rights in Japan are defined as the right to catch or culture specific fish for commercial purposes, in specific areas using specified methods. Fishing rights are issued by the prefectural government through the "Fishing Co-ordinating Committee for Sea-Districts", and by the "Multiple Sea-Districts Committee" for issues that relate to overlapping districts. In general, fishing rights in Japan are divided into two main categories.

The first category includes common fishing rights, which relate to various small scale coastal fisheries and the demarcated fishing rights owned by fishermen's co-operative associations. These rights are known as co-operative-managed fishing rights. Although associations are granted rights, they seldom engage directly in fishing operations. Their function is rather to own the fishing rights and to administer the use of fishing grounds in the interest of their members.

Equality of opportunity however is not always achieved, as fishermen are apt to form bias groups, and fishing rights may in reality only be exercised by a limited number of fishermen. This problem is theoretically addressed by the rules for fishing ground utilisation being decided by a two-third majority vote at a general meeting of each association.

The second category of fishing rights includes the demarcated and set net fishing rights awarded to individuals and companies as well as to co-operative associations. Fishing rights are allocated according to the following divisions with licences valid for either 5 or 10 years:

1. Set net fishery rights - for Salmon and yellowtail (1900 licenses)
2. Demarcated fishery rights - culture of seaweed, oysters, pearls etc. (11,500 licenses)
3. Common fishery rights - seaweed collection, shellfish harvesting and beach seining.

Theoretically the use of fishing grounds should change with the natural, social or economic needs of the time and the following procedures should be followed before a fishing licence/quota is allocated:

1. The fisheries co-ordinating committee investigates scientific and rational ways to use the fishing grounds.
2. An announcement is made specifying the fishing method, location and terms of the license.
3. Fisheries co-operatives apply for the rights.
4. The license is granted after the examination of the applicant's qualifications.

Licenses are mainly granted to co-operatives, and they (the co-operatives), determine: the qualification of those who can operate under the given license; the fishing season; closed areas; and the penalties for offenders. These regulations come into effect if more than two-thirds of the fishermen consent and the governor gives his approval.

In practice however, administering and governing the way fishing rights (or fishing licenses) are allocated is plagued by Japanese bureaucracy, and representatives of the provincial government have the right and the ability to interfere in the way in which fishing quotas and licenses are allocated.

Licenses for distant-sea fishing which cross several prefectural boundaries are issued by the national government in accordance with the Fisheries Law or the Marine Resource Conservation Law. The following steps must be followed before the licence is issued:

1. The authorities announce the number of vessels to be allowed for each type of fishing operation, the gross tonnage, and the areas and seasons.
2. Licenses are granted to those applying within special time periods, but priority is given to those with experience or who have had previous licenses.
3. Fishing licenses are granted per vessel but are transferable in cases where ownership changes or where vessels are rented. The validity of licenses is usually 5 years if issued by the minister and 3 years if issued by the governor.

Conclusions

The Japanese fishery employs diverse fishing methods to exploit diverse marine resources. Its management resolves conflicting interests between fishermen by setting up national and local regulations regarding the licensing of fishing rights and rules about fishing operations. These are supplemented by rules of the Fisheries Co-ordinating Committees for Sea Districts and in addition, detailed agreements can be made voluntarily between the parties concerned through the fisheries co-operative.

Fishery rights are an important distinguishing characteristic of the Japanese coastal management system. In contrast to most other countries, Japan has assigned virtually all coastal fisheries, fishing areas, and sea culture areas to local fishermen in co-operatives, on the basis of traditional fishing areas and patterns. These fishery rights are subject to government approval and the payment of a small registration fee by the fishermen. They do not constitute ownership of the resources or the fishing area, but they do result in a permanent tenure arrangement that must be compensated for in the event that a competing use seeks to operate in the area covered by the right. Apart from the increased incentive and responsibility for long-term management that these fisheries rights encompass, they provide fishermen with a powerful legal foothold in disputes over the management of coastal areas. In addition, the fact that fishermen are organised into

geographically and traditionally based co-operatives makes them extremely cohesive and powerful groups in any disputes over territorial use rights.

The Japanese are the biggest consumers and importers of sea products in the world. They also use their high-seas fishing fleets and foreign fishing grounds to obtain fish products. Resources in their own coastal waters however are badly exploited. During the early 1970's, Japan initiated a very ambitious program to increase annual fisheries production by 4.8 millions tonnes (half of their total annual production at that time) by investing in aquaculture facilities. A budget of US\$ 870 million was set aside during 1976-1982 to develop the project. However, almost all preliminary studies of the investment suggests that there was no economic justification for it, and financial commitment to the project was upheld more for political and social reasons.

While the system of fisheries management in Japan is often held up as an example of a successful method of managing inshore fisheries and does indeed have many merits, it depends on strong traditional fishing community structures, and it is hard to see such a system being effective anywhere where these type of structures are not well developed. In addition, it should be remembered that the large number of participants in the fishery has had certain consequences: fish resources are depleted, the number of aquatic species on the brink of extinction in Japanese waters had increased by 50% from 16 species to 24 species during the past year, fishing communities still remain in poverty, the inshore fisheries sector provides little economic benefit to the nation in the form of resource rents, and the decision making process is bureaucratic and susceptible to political manipulation.

The Pacific Cod Fishery (*Gadus macrocephalus*)

(Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis of Alternatives to Allocate the Pacific Cod TAC by Gear and/or Directly Change the Seasonality of the Cod Fisheries, National Marine Fisheries Service, Washington, 27th December 1993)

Overview

The Pacific cod is distributed widely over the eastern Bering Sea continental shelf and slope, as well as in the Aleutian Islands region. The eastern Bering Sea groundfish fisheries in the exclusive economic zone are managed under the Fishery Management Plan for the Groundfish Fishery in the Bering Sea/Aleutian Islands Area (BSAI). For the domestic fishery in the BSAI, trawl gear was dominant from 1981 to 1992, however its dominance decreased rapidly from 1989. From 1981 to 1986, trawl gear accounted for 100% of the domestic fishery cod catch but this figure fell to 97% for the next two years, and to only 44% in 1992. Meanwhile the percent of the domestic fishery cod catch taken with longline gear increased from 0% in 1986 to 3% in 1987 and 1988, and then increased rapidly reaching 49% in 1992. For the 12 year period as whole (1981 to 1992), the total joint venture and domestic fishery catch of cod was about 1.4 million tonnes, with domestic catch on its own being about 1 million tonnes. 81% of the joint venture and domestic catch, and 74% of the domestic catch alone, were taken with trawl gear, with the majority of the remainder taken by longline gear and a small percentage (about 2%) by pot gear.

The increase in the percent of catch taken by longline and pot gear was partly the result of seasonal closures in the trawl fishery beginning in 1989 due to halibut allowances having been taken i.e. because of the bycatch problem, the cod trawl fishery had to be closed to prevent further catches of halibut. These closures provided improved market and regulatory opportunities for the use of non-trawl gear. These opportunities increased participation in the cod fishery by vessels that had been designed to use longline or pot gear, and by trawl vessels that were refitted to use fixed gear either just during trawl closures or during the entire fishing year.

Survey results indicate that biomass increased steadily from 1979 to 1981, then remained relatively constant from 1981 to 1989. The first significant decrease in biomass was observed in 1990, when the biomass estimate dropped by 26%.

Discussion on the merits of different gears

In 1993, the National Marine Fisheries Service examined the estimated net benefits per metric ton of cod catch for trawl, longline and pot gear, in connection with a proposal to allocate the Pacific cod TAC by gear. Each gear uses different inputs and produces different outputs, and the difference between the two for a particular gear use provides a measure of the net benefit of that use. Net benefits were based on estimates of the following:

1. Gross revenue per ton cod catch based on groundfish products and FOB Alaska prices.
2. Harvesting and processing costs per ton of cod catch paid by the owners of harvesting and processing operations.
3. The opportunity cost of groundfish TAC species and prohibited species bycatch per metric ton of cod catch where groundfish bycatch is the catch of groundfish other than cod.

The estimates were used to calculate the net benefit per ton of cod catch for each cod fishery. The estimates of net benefits per ton of catch provide an aggregate measure that summarises the joint effects of difference in product value, variable harvesting and processing cost, prohibited species bycatch cost, and groundfish bycatch cost all per tonne of cod catch. The calculations were carried out for a variety of assumptions and demonstrated that, with respect to net benefit per tonne of cod catch, the trawl fishery generally had the highest annual net benefit, and under none of the models had a net benefit lower than the longline fishery.

Biological impacts of different gears were also considered in the study as different cod fisheries may affect biological productivity through effects on yield per recruit, but it was shown that yield per recruit was not affected by large changes in the distribution of cod catch between longline and cod trawl fisheries.

A number of other factors were also discussed:

1. It was demonstrated that the longline fleet was much more dependent on the BSAI cod fishery than the cod trawler fleet in terms of the number of weeks operating and the product value. The dependence of a vessel on a fishery is also determined by its ability to be refitted to participate in other fisheries, and it is typically much easier to refit a trawler to use longline gear than it is to refit a longline vessel to use trawl gear.
2. the likelihood of gear conflicts generally increases with any reallocation of the cod fishery from trawlers to the longline and pot fishery, and typically there are fewer conflicts among trawlers than there are either among non-trawlers or between trawlers and non-trawlers.
3. Significant benefits are gained from stability and decreased uncertainty over fisheries management policy.

The Philippines Fishery

(An overview of Philippine Fisheries Problems and Potentials, Jurgen Saeger, 1989; Problems Relating to Coastal Resources Management Systems with Specific Reference to the Philippines, Kazuo Inoue, 1990; Coastal Resources Management in Panguil Bay, Philippines, Bengzon and Francisco, 1992).

Overview

Through a complex system of local currents, waters in the Philippines become enriched with nutrients through natural siltation processes from land, and through seasonal upwelling. These conditions, along with the location of the country in the tropical belt, result in a productive marine ecosystem which is the richest in species diversity in the world: 2,500 fish species and over 300 coral species are found in the country. Fisheries represent a major sphere of economic activity with 200 commercial species, over 1 million people employed directly in the fishery, and about 7 million people (about 10% of the population) depend on fisheries and supporting industries either directly or indirectly for their livelihood. Fisheries contribute about 4.5% of total GNP and total production currently stands at over 2.5 million tonnes.

In pre-colonial times all fishing areas and their stocks belonged to the community or tribe. “Fisheries management” was implemented whenever it was thought necessary to sustain a bioeconomic optimum use of fish stocks by taboos or seasonal restrictions. These regulations however became obsolete with Spanish colonial times, when it was declared that all bodies of fresh and marine waters belonged to the crown and afterwards, in consequence to the state. Although coastal communities were given some remnants of self-rule and use rights, it was a centralised government that decided how resources had to be utilised. In the community, a consensus of irresponsibility became established; property that had once been communal was converted into a resource that was free for all.

In 1905, total landings were approximately 500,000 tonnes a year, equivalent to a per caput catch of 4.2 tonnes a year. By 1976, this per caput catch had fallen to 1.33 tonnes a year, and has continued to decline to a present per caput catch of 0.88 tonnes per year. The Philippines have been subject to a number of different types of overfishing:

1. Growth overfishing: it is estimated that mesh size limits needs to be increased by 50% from 3 cm to 4.5 cm to attain optimum utilisation of resources. Growth overfishing is particularly serious in the tuna fishery, where 70% of landings, mostly from fish aggregating devices, consist of individuals with a body weight of 1.0 kg. Fish are distributed countrywide in wet fish markets, and it is estimated that at least 200,000 tonnes of undersized tuna are caught each year. Overfishing has resulted in large imports of tuna, sardine and mackerel, estimated at 221,000 tonnes in 1991 to fulfil market demand, with serious implications for foreign exchange.
2. Ecological overfishing: the ecological equilibrium is thrown off balance so that many of the commercially valuable species are replaced by bottom dwelling invertebrates or large zooplankton-like jellyfish.
3. Economic overfishing: for the demersal fishery (snappers, croakers, breams soles etc.), research has shown that fishing effort is approximately three times that necessary to attain the MEY. Dissipated annual economic rent for the demersal fishery is estimated at US\$ 130 million, with US\$ 242 million dissipated from the small pelagic fishery and about US\$ 300 million from the large tuna fishery.
4. Malthusian overfishing: poor fishermen are forced to destroy the resource on which they depend through illegal fishing methods such as illegal mesh sizes or the use of dynamite fishing.

Management

Commercial fishing operations with vessels of over 3 GRT are licensed by the national government, while small-scale fisheries are controlled by local municipalities which have jurisdiction over “municipal waters” up to 15 km from the shore. Commercial fisheries employing about 50,000 people account for just under 30% of total catches, with small-scale capture fisheries employing over 650,000 people contributing around 35%. The remainder of the catch is supplied from inland fisheries (8%) and aquaculture (27%).

Prior to 1989 there was no effort control on small-scale fisheries, and the result was a classic case of increasing fishing effort and overfishing through a large number of participants in the fishery and multiple gear use. The MSY for small pelagic and the demersal fishery was reached shortly after 1975. With 1.3 million people currently engaged in small-scale fisheries, it has been estimated that every second one of them must find alternative employment in other sectors if resources are to be exploited on an optimal level. (This assumes constant technological levels in the fishery, and with technological innovations, an ever greater reduction in the number of fishermen will be necessary)

In response to these problems the Department of Agriculture prepared a Fisheries Sector Program (FSP) and Integrated Management Plan for the Coastal Resources which began in 1990 in 12 large coastal bays selected because of their urgent reorientation needs. Funding support to the tune of US\$ 155 million came from the Asian Development Bank and the Overseas Economic Co-operative Fund of Japan. A program Management Office is responsible for the management and

implementation of the FSP and provincial fisheries management units have been established to assist in policy formulation and implementation.

The principal objective of the program is to eradicate all illegal fishing in coastal waters, and reduce fishing effort by transferring fishermen to other jobs in aquaculture, fish farming or local manufacturing industries when necessary. License fees for commercial fishing will assist in limiting fishing effort while improved law enforcement and the promulgation of municipal ordinances on fisheries will also help to manage the fishing effort at the local level within sustainable limits. Fish sanctuaries have been established along with zoning plans, fisheries law enforcement, mangrove reforestation, community organisations and new institutional arrangements.

Conclusions

The consequences of a historical lack of effort control on small-scale fisheries has proved disastrous in the Philippines. Population pressure and a situation of access combined together to increase fishing pressure on the stocks to unsustainable levels. Economic benefits from fishing have, as a result of large numbers of participants, been small. Subsistence fishermen are now among the poorest of the poor in Philippines and this has caused political and social instability. The depletion of coastal resources has left the majority of fishermen living at marginal income levels. The fisheries have been characterised by much illegal fishing, and authorities have often been reluctant to control illegal fishing because illegal fishermen are supported by local politicians, and local administrators are thus afraid of applying the law strictly. It has therefore been difficult to ensure compliance with legal measures for coastal resources management.

Progress has been made as a result of the Fisheries Sector Program with a reduction in illegal fishing, stronger law enforcement and a recovery of resources. Problems remain however, as it has proved difficult to give access rights to co-operative societies as they are poorly developed, in comparison with Japan for example, because coastal fishermen tend to be independent and have not historically been controlled by strict village community rules.

Discussion and conclusions

The key issue motivating this study is the question of how one goes about obtaining maximum benefit for most people out of South Africa's living marine resources. This question touches on a wide range of academic disciplines. It is also a question that can be and currently is being asked of other forms of economic endeavour in the South African economy. From the work presented here, it appears that there are two broad approaches. These are, roughly speaking, either

a) to embark on the 'free market' orientated approach to fisheries management

or

b) to have more intimate involvement by government in the economic workings of the fishing industry, and in particular in the process of allocation of fishing rights.

Both (a) and (b) encompass a variety of approaches, and there is a considerable grey area between the two. A few key approaches and attitudes can however be identified. An important example of the second type [Type (b)] is that of the community based fishery, based on artisanal fishing technologies. There is a prevalent view that this form of fishing is better for South Africa than the larger industrial type of fishing operation. The thinking behind this is probably related to an extent to the 'small is beautiful' arguments proposed by Schumacher, and to an extent to the notion of the 'goodness' of the 'noble fisherman'. This general view lends support for a system of allocation of access rights which is biased in favour of small scale fishing based on fishermen living on the coast near to the resource using unsophisticated technology. Another feature of this approach which is appealing to its proponents is that it leads to the direct allocation of fishing access rights to the intended beneficiaries of South Africa's living marine wealth. Benefits are therefore designed to accrue directly to the users, rather than indirectly by way of employment, shareholding or a general increase in the GDP of the nation and the nation's balance of trade. The participants of the

hypothetical artisanal fishery are therefore not so much engaged in an economic enterprise as they are earning a living for themselves, and there is a subtle and important difference between these two activities. We note that no clear concept of workplace hierarchy exists in the hypothetical artisanal fishery and the fisherman is the quota holder is the wage earner is the skipper.

The archetype of approach (a) is the developed modern demersal trawl fishery which is characterised by:

1. **Use of technology designed to enhance efficiency and to capitalise on economies of scale**
2. **Clear workplace hierarchies and delegation of responsibilities**
3. **Fishing as an economic enterprise**
4. **Substantial post-harvest processing of fish for access to high value international markets**
5. **Vertical integration of harvesting, processing and marketing sectors.**

Proponents of this second approach to the management and development of marine fisheries claim that the indirect benefits to employees and to the citizens of the country via taxes and the balance of trade exceed those realised in artisanal type fisheries.

The arguments for and against these two approaches could occupy the pages of theoretical academic journals for decades. The study reported on here is based, instead, on an empirical examination of actual practical experience with the management of demersal fish resources, or with general management practices of all the fish resources of a particular nation. Our conclusions from this exercise are as follows.

Firstly, we note that issues concerned with the management and allocation of fish resources cannot be addressed in isolation from global economic and social developments. Key amongst these are (a) the population explosion (the world's population has doubled since the 1950's, and has increased sixfold since 1800), (b) the associated increased demand for fish products, particularly in the high value high quality area but also as a basic source of protein, and (c) easy access to international markets - basically the development of a global market. Although increasing demand for food production is feasible through farming and aquaculture, any production increases that might be feasible for fish resources are very modest by comparison, since the productivity of fish stocks is limited by natural forces. The most important challenge for fisheries management is either to try to preserve current catch levels, or, to attempt to enhance long term yield by employing policies which eventually drive stocks to a level that generates a high level of sustainable yield. These management options involve difficult trade-offs that can only be implemented if mechanisms for strict control and enforcement of fishing regulations are in place.

We document three main fisheries where artisanal modes of access and harvesting technologies are being practiced, namely, the Philippines, Japan and the Moroccan hake fishery. Our findings are as follows.

The Philippines: The Philippines fishery is often used as an example of a community based fishery that sustains large numbers of people. The following is a quote from a study conducted by the Manila Department of Labour and Employment and the International Labour Organisation's Asian Employment Program, 1993.

"The coastal environment of the country has suffered severely from overexploitation, destruction and abuse. The resource in its present condition is not suited to offer adequate livelihood for the current number of users, especially in the small-scale capture fisheries sector. In order to revert the past and the present degradation, the number of small-scale fishers has to be drastically reduced to a level that grants resource exploitation at optimum levels".

In reality therefore the management of fisheries in the Philippines has resulted in a major crisis, and policy makers are calling for radical steps in an attempt to halt the irreversible annihilation of stocks. In the Philippines it is estimated that with 1.3 million people currently engaged in small-scale fisheries, 50% of them must find employment in other sectors if resources are to be exploited at an optimal level.

Japan: In Japan, the mode of access is linked to a feudal system of a bygone age, and its modern counterpart is heavily bureaucratic. The economic benefit from Japan's inshore fisheries is at a subsistence level, their fisheries are hugely subsidised and the main function that management

achieves seems to be to maintain a level of political peace. Biologically the resources are in a shocking state, with 24 species being classed as on the brink of extinction. Fishing communities exist in a state of poverty and there is little or no economic rent.

Morocco: Since artisanal fisheries generally only provide fishermen with survival based on a subsistence level, they are not in a position to be able to reduce catches when this is needed to relieve pressure on resources, because of the impact it would have on their economic survival. The result is intense social and political pressure to permit the continued access to resources by large numbers of people, and technical measures to reduce fishing effort are also strongly resisted. In the Moroccan hake fishery for example, artisanal fishing operations are not in a position to comply with the same mesh size regulation as Spanish industrial trawlers because of the effect it would have on their incomes. The hake resource in Morocco is severely overexploited.

General points: The following general points about artisanal fishing emerge from these case studies:

1. **Dissipation of rent:** Artisanal fishing promotes the fragmentation of access rights to the fishery leading to the dissipation of economic rent via a loss of the advantage of economies of scale, and via open access type escalation of fishing effort. Further rent dissipation occurs because of the lack of access to high value international markets.
2. **Control:** Control of the fishery is compromised by the large number of users and the dependence of fishing communities on the resource for their daily survival. Although large scale abuse of fish resources can be caused by either a centralised industrial sector or by a fragmented artisanal one, the former can be harnessed and controlled relatively easily while the latter cannot. In the Philippines it is estimated that with 1.3 million people currently engaged in small-scale fisheries, every second one of them must find employment in other sectors if resources are to be exploited at an optimal level. As larger numbers of fishermen become involved in the fishery and competition for catches becomes more severe, there are increased pressures in artisanal fisheries to ignore any fishing regulations that may be in force. The large numbers of participants associated with artisanal fisheries means that enforcement and surveillance of fishing activities is extremely difficult, as has been proved in the case of the Philippines fishery. In Japan, where 300,000 people are involved in fishing activities, traditional community structures have been utilised to control access and implement regulations on fishing activity. However for such enforcement to be successful, strong and well established community structures must be in place. In Japan these structures date back to feudal times and are entrenched even to this day. It is difficult to see how artisanal fishing community structures, that have never existed in South Africa, could be created and utilised in a system of resource allocation or property rights. We note that population increases in the Transkei in recent years, have resulted in massive pressure on inter-tidal resources because of the lack of any effective way to control access.
3. **Benefits to users:** The result of point (1) and (2) above are that artisanal fishermen are often locked in a state of poverty and the resource is heavily depleted.
4. **Human population growth:** The concept of the artisanal “noble fisherman” is based on the demographic realities and population size of the past century. Since the artisanal mode of access to marine resources leads to fishing pressure which is linked to population density, the increasing human population is a threat to marine resources where artisanal modes of access exist.
5. **Options for stock rehabilitation:** Since artisanal fisheries generally only provide fishermen with a subsistence level of income, they are not in a position to be able to reduce catches when this is needed to relieve pressure on resources, because of the impact it would have on their economic survival. The result is intense social and political pressure to permit the continued access to resources by large numbers of people. Technical measures to reduce fishing effort are also strongly resisted.

6. **Scientific data collection:** Data collection for use in stock assessment analysis, so important in ensuring the long-term sustainable management of a fishery, becomes difficult in artisanal fisheries because of the large numbers of fishermen and vessels involved, and data reliability is poor.
7. **Multi-species considerations:** Artisanal fishing typically targets multispecies fisheries using multiple gear types, as do industrial multispecies fisheries with an artisanal component, and this poses management problems due to the multispecies nature of fish harvesting which the management of any one species extremely difficult.

In summary, artisanal fisheries are characterised by (1) increasing pressure for access to resources in response to increasing population levels, (2) stock depletion, (3) economic and political obstacles to limiting access, (4) dissipation of the bulk of the potential economic rent from the fishery, (5) an absence of value added processing, and, (6) participants locked into a cycle of poverty. Hence, even though an artisanal mode of resource access offers clear political benefits and benefits of perceived equity of access, there are problems that need to be weighed up.

Most of the demersal fisheries considered in this study fall into the class of industrial Type (a) fisheries described above. In these fisheries differences in control and management centre around the following considerations:

1. **The mode of access:** Whether limited access or open access and if the former, then how this access is granted, i.e. as an individual quota, or on the basis of an effort allowance as in the South African squid jigging industry. What conditions apply, e.g. the nature of any fishing levies.
2. **Security of access:** Whether access rights are allocated in perpetuity, and if so whether any conditions are attached. Whether these rights are allocated for a limited period of time, what this period is, and what conditions apply for renewal of access.
3. **Divisibility and Transferability:** Whether access rights are freely divisible and transferable and if not, what conditions apply for transfer and/or division of rights.
4. **Other management regulations:** An important consideration here is whether these are relatively simple or whether complex, bureaucratic and cumbersome.

As with the review of Type (b) fisheries, in the case of Type (a) fisheries we are concerned about problems of rent dissipation, ease of control, benefits to users, benefits to the nation, options for stock rehabilitation, ease and reliability of scientific data collection and other characteristics as they emerged from the case studies.

At the outset, we note that many Type (a) industrial fisheries have failed both biologically and economically, and others have failed economically but not biologically. Other fisheries have not experienced dramatic collapse transitions but nevertheless have gradually become trapped in high cost unproductive situations. The following contributing and/or causal factors were identified:

1. **Open access:** In certain cases, open access modes of allocation of fishing rights (e.g. USA east coast groundfish fisheries).
2. **Scientific factors:** Scientific ignorance combined with politically/economically motivated TAC allocations (e.g. Newfoundland cod).
3. **Environmental factors:** Environmental variability.
4. **Modern harvesting techniques:** The advent of modern harvesting techniques and the financial resources to deploy these on a very large scale.
5. **Excess capacity:** A general over-abundance of harvesting capacity on a global scale, intense political and economic pressure to utilise these capital resources, and the international mobility of these fishing fleets.
6. **Excess capacity in Europe:** The fact that many European nations developed itinerant international fishing fleets backed up by extensive shipbuilding and fishing gear construction industries during the growth of industrial fishing after the second World War. After the International Law of the Sea Convention, the exclusion of foreign fleets from coastal waters all over the world left these industries in an overcapitalised state with heavy financial debts. This

led to political/economic pressure from these industries on their governments to explore, in any possible way, and at any price, options for access to fish stocks anywhere in the world.

The main points which emerged from our examination of the industrial case studies are:

1. **Dissipation of rent:** It is clear that large industrial fisheries have the capability to remove large quantities of fish from the sea and have in the past been guilty of overexploiting resources, leading to rent dissipation. This has largely been the result of over-investment in fishing effort before the limited nature of fish stocks was fully appreciated. Controlling the rate of fishing through the regulation of effort and by controlling catch capabilities can be difficult, as fishermen invariably find ways to improve performance by making better use of catch methods at their disposal or by increasing aspects of fishing effort that are not controlled. Catch quotas can be effective at conserving stock biomass in industrial fisheries, but if set on a global basis for a fishery, do not prevent increases in fishing effort. This increased effort, as evidenced in the Icelandic fishery prior to the introduction of ITQ's and in the Atlantic halibut fishery in 1987 where 70% of the global TAC was taken in just 3 days, often results in shorter and shorter fishing seasons, with overcapitalisation and seasonal interruption to onshore processing facilities (implying significant rent dissipation).
2. **Transferability and divisibility of quotas:** Catch quotas therefore need to be allocated individually and should be freely transferable to ensure economic efficiency. ITQ systems have largely been successful in increasing economic efficiency and economic benefits in both New Zealand and Iceland, and in providing for the long term sustainability of the resource. Noting the problem of initial allocation, ITQ's are popular with fishermen, but become more difficult to enforce as more operators become involved in the fishery. Targeted industrial fisheries with little or no artisanal activity such as the South African and Argentinean hake fishery, produce high quality product and can make large contributions to national economic welfare. Value-added products are traded internationally into diverse markets providing foreign exchange contributions and net economic benefits to the nation..
3. **Control and options for stock rehabilitation:** Fisheries regulations are generally easier to enforce in industrial fisheries than in artisanal fisheries, and have dramatic effects since management is dealing with only small numbers of vessels that are catching large quantities of fish. Large companies are also in a position to be able to absorb temporary cuts or reductions in catch rates as part of a long term strategy to rebuild stocks without facing untenable economic conditions, and a sensible long-term view has been taken by the industry in both South Africa and Namibia over recent years. In addition, large industrial fishing companies are able to diversify their activities into other fishing activities or into non-fishing ventures, particularly when the industry is vertically integrated. Although both the artisanal and industrial case studies presented here support the theoretical prediction that open access to fish resources invariably leads to resource depletion, a fundamental difference between artisanal and industrial fisheries appears to be the forces driving increased demand for access, and the prospect of addressing the problem. The escalation of artisanal fishing effort is driven largely by increases in population density, while increases in industrial fishing effort are linked to points (2) to (6) above. There are a number of examples where stock rehabilitation in industrial fisheries has been feasible because of the limited number of participants involved (Namibian hake, South African hake, Icelandic and Canadian cod prior to and immediately after the declaration of EEZ's). Stock rehabilitation in the artisanal Philippine and Japanese fisheries by contrast seems faced with virtually insurmountable political and social obstacles.
4. **Scientific data collection:** While monitoring and data collection in industrial fisheries is not hampered by a preponderance of users as with artisanal type fisheries, a potential complication is the phenomenon of hyper-stability in which creeping efficiency increases can result in catch rate providing a misleading impression of resource trends. Good examples are the dramatic increase in catch rates following the introduction of new types of hooks in the Atlantic halibut fishery in the 1970's, and the trawling innovations in the Newfoundland cod fishery (a good local example is the failure of crew member allocations to limit effort in the squid jigging

fishery in South Africa). It is essential that the scientific management of demersal resources includes an annual or even biannual survey for obtaining independent estimates of trends in resource biomass.

5. **Effort as a means of regulating access to a fishery and impact on the resource:** Because of the potential problem of hyperstability, and generally because of the difficulty of quantifying the relationship between fishing effort and fishing mortality, effort is not a successful means of controlling and regulating a fishery. In many cases where this is the basis of management, TAC's and individual quotas are being seriously considered as an alternative, more effective and far simpler understood and implemented management mechanism.
6. **Benefits to users:** Benefits to users in industrial fisheries accrue through direct employment or as part of the normal benefits enjoyed by shareholders in any economic enterprise. Although not easily quantifiable, the concentration of capital in industrial fisheries leads to sophisticated post-harvest processing of fish to maximise end prices in a diverse and high priced international market. This implies considerably more employment linked to the resource than is the case in artisanal type fisheries where limited processing is available and where the least capital intensive means of disposing of product in the highest priced market is often sought. This limits ones marketing options and makes one very vulnerable to price fluctuations and to competing products.
7. **Benefits to the nation:** Since artisanal fisheries generate very little taxation compared to industrial fisheries, the benefits to the nation through foreign exchange earnings and taxation (income tax, normal company tax) from industrial fisheries is comparatively very large.

How then should equity be maintained when allocating access rights, and do economic or social criteria best serve the nation?

It is important to consider that determination of what is fair is very subjective. Management regulations controlling access invariably favour preventing pre-emption of one group of participants by another. On a social level this may at first appear unsatisfactory. However, there are strong arguments to support the view that it is most fair and equitable to the nation as a whole to have an allocation that maximises the benefits that the nation can receive from its resources. While it may be politically attractive to support a social approach to the allocation of access rights, it should be remembered that on a macro-economic level, South Africa will be best served by allocating rights to those who will use them most efficiently, and who will thus generate the most economic benefit from the fishery. These benefits can then be used to promote both the economic and social development of the country, thereby removing the perceived dichotomy between social and economic objectives. The case studies have shown that the industrial sector is most likely to provide maximum economic benefits from the fishery and should thus be favoured in the allocation of access rights.

Trying to decide what is equitable has resulted in numerous conflicts over access rights in many parts of the world, as highlighted in the case studies presented here. Political and social arguments about access to fish resources have often had negative consequences for both the long term sustainability of fish stocks (as in the Pacific cod fishery where social and political pressures ensured that TAC's remained far higher than the MSY, resulting in the collapse of the cod stock), and the contribution of the fisheries sector to the economic development of the country. Policies on access that attempt to satisfy everyone, often end up being confused and satisfying nobody. Fisheries management involves making hard decisions and must be based on rational and informed analysis, not on emotive argument.

ANNEX I: A preliminary submission to the Access Rights Technical Committee by the South

African Deep-Sea Trawling Industry Association (SADSTIA)

Background

During the last two years extensive debates have taken place concerning the South African fishing industry. This process started with the formation of the Western Cape Fishing Forum in 1994 and has attracted a large number of interest groups and individuals from the formal fishing industry and from many other sectors. Although many issues were discussed and presented in the Fishing Forum and its committees, it soon became clear that the focus of attention of most participants was the issue of access rights (fishing rights), which can be crudely summarised under the following headings:

1. **Who should, or should not, have the right to fish in South African waters?**
2. **On what basis should such rights be granted?**
3. **Who will allocate these rights?**

and

1. **What is the legal status of these rights?**

The Fishing Forum, with its open door policy to participation, was soon found to be incapable of carrying out its task. The main reason was that it tried to accommodate too many individuals representing too many conflicting interests. In order to simplify and speed up the process of establishing a new fisheries policy for South Africa, Dr D de Villiers, Minister of Environmental Affairs, appointed a Fisheries Policy Development Committee (FPDC) which attempted to give equal representation to all identified interest groups. The mandate of this committee was to produce, through a process of discussion and negotiation, a consensus document which would form the basis for a South African fisheries policy. One of the first tasks of this committee was to review all existing policy statements and views from all interested and affected parties and to produce a document that would combine points of agreement, and highlight areas of conflict. The result of this process was again to highlight the important issue of access rights. A technical committee was established with the task of reviewing different access rights options.

This submission is the response of SADSTIA to a request (dated 4 October 1995) from the chairman of the FPDC Mr Mandla Gxanyana for all interest groups to submit their views on access rights to Prof. George Branch, the chairman of the access right technical committee, by not later than Friday 13 October 1995.

The views presented here are supported by a report of an in-depth investigation carried out by SADSTIA into the merit and demerits of different approaches to fishing access rights in a large number of fisheries around the world. This report will be submitted to the access rights technical committee by no later than 31 October 1995.

General comments on access rights

Fish resources have limited production potential. It is normally desirable to maximise the economic return from fishing by stabilising the resource biomass near to its point of maximum productivity. In hake this is generally thought to occur at about 50% of the stock carrying capacity - equal to its average pristine size. To achieve this goal harvests have to be strictly regulated by limiting and controlling fishing mortality. Limitations on fishing mortality can be achieved in many ways. Examples are: a global TAC, gear and vessel regulations, season and area restrictions and combinations of all of these. However, none of these measures can succeed without direct control over the number of fishing participants, viz. limited entry. Without limited entry, fish resources are doomed to biological and economic degradation. The two main reasons for this are:

1. **The difficulty of enforcing fishing regulations for large numbers of participants**

2. The dissipation of economic rent resulting from escalating fishing effort.

The view that an approach to the allocation of access rights to marine resources based on social entitlements rather than on pure economic merit will improve the total social and economic benefit is still to be proven. A review of many demersal and other fisheries in the world (the document referred to above that will be submitted to the FPDC) shows that open access, artisanal like fisheries, fail to achieve the socio-economic benefits attributed to them by the promoters of this approach to access rights.

Many case studies show that it is virtually impossible to rehabilitate overexploited, open access and/or community based fisheries, since participants lack any alternative sources of income, and have no saving which will enable them to survive even short term reductions in catch. For example, the western Mediterranean hake (*Merluccius merluccius*) is artisanal by nature. About 2600 trawlers fish the western Mediterranean hake: 1230 in Spain, 851 in Italy, 294 in Algeria, 207 in France, 78 in Morocco and an unknown number in Tunisia. The average capacity of these vessels is 40 GRT and the average total annual catch is 16 000 tons. This is on average 6.15 ton per boat, but in many cases much less. Most of the hake caught are less than 20 cm long since the agreed legal mesh size is 40 mm (this rule is typically ignored by coastal fishermen). This is a multi-species fishery that targets hake and shrimp with the same gear. The value of the catch barely covers harvesting costs, and fishermen live in poverty. In order to restore the rent and sustainable yield potential of the fishery, it would be necessary to more than halve fishing effort, and to substantially increase the codend mesh size. None of these options is practical, since the socio-economic consequences of such steps are unbearable for the majority of fishermen.

Large industrial fisheries do indeed have the ability to exploit large quantities of fish (which means that they must be tightly controlled), but they can bear painful economic measures when necessary by diverting effort, utilising past profits, and/or by borrowing money in the free market, provided that they can be guaranteed a share in the future benefits of resource rehabilitation. Examples of this are the South African and the Namibian fisheries, which with relative ease reduced catches and now enjoy stable and even growing resources. South Africa has, to date, escaped the form of irreversible resource degradation experienced in many other open access / artisanal fisheries. This is mostly due to the tightly controlled entry system over the last two decades.

The centralisation of effort also leads to further improvements in economic rent, a more efficient operation, better control, a large number of jobs in fishing, processing and marketing, and ultimately a higher net social benefit.

Opportunities for a better distribution of wealth generated by fishing operations should be sought, but not through the fragmentation of the industry. The democratic access to demersal and other resources can be achieved by the acquisition of shares and quotas, or by the development of new resources and aqua-culture.

It is no longer possible to consider the economic reality of fisheries management out of context of the development of the global economy and the explosion of the human population. Small scale artisanal methods of resource utilisation are unable to cope with the increasing demand for fish protein. A process that took place over the last decade has categorically exposed the weakness of a pure social approach to economic development. The temptation to accommodate an ever-increasing demand for the allocation of quotas based on social/political merits might lead to the promotion of an academically sound but practically disastrous access rights policy. The industry suggests that the access rights committee carefully assesses real cases from around the world on their merits before making its recommendations.

The trawling industry, through SADSTIA, has conducted a study which has reviewed a large number of cases around the world on hake and other mostly demersal resources. This study, which will be submitted to the technical committee on access rights before the 31 October 1995, reached the following three major conclusions:

1. Fishing overcapacity, overcrowding of fishermen, and an excess of fishing effort are the main issues of concern in fisheries around the world. The trend over the world is to

drastically limit entry into fishing wherever it is politically possible, regardless of the existence of other control measures.

- 2. When the direct control of access via individual quotas is replaced by a complex of gear and vessel regulations, control and enforcement of fishing regulations are poor, and production and economic rent are small. Another outcome of this approach is the development of an extremely bureaucratic and inefficient management system.**
- 3. Fisheries which have a large number of participants but are run on free market principles naturally streamline their activities through a voluntary process of centralisation, effectively reducing the number of participants through free market economic forces.**

SADSTIA's general view regarding fishing rights

SADSTIA presented its view regarding rights to the exploitation of the demersal resources of South Africa and their view on the format of access rights in this country in their submission to the FPDC "Policy proposals for the South African trawling industry". Its views are summarised below:

The trawling industry supports the principle that fishing access rights (fishing quotas or fishing rights) should be allocated on a long term or a permanent basis. This will stimulate investment and promote the responsible exploitation of the resource by fishermen and fishing companies, since participants will have a real stake in the fishery and they stand to lose if they are irresponsible. The industry recognises that at present there is considerable pressure from a number of individuals and groups to be allocated access rights to hake. These demands, regardless of their merit, cannot be met if the result would be loss of quota by existing quota holders out of the 148 000 tons of hake presently allocated since the social and economic cost to companies and their workers will be unacceptable.

Hake fishing rights should be expressed as a percentage of the TAC in order to ensure that both the benefit of an increase in the TAC and the cost of a decrease in the TAC is fairly shared between the participants in the fishery.

Fishing rights can only be held by persons/companies who are themselves owners of a trawler. This criterion should also be a requirement for existing paper quota holders in the industry. A paper quota holder is defined as a party who either (a) does not actively engage in fishing but makes arrangements for his/her quota to be fished by an owner of a trawler or, (b) who appears to be engaged in fishing but has in fact formed a non-risk sharing joint venture with a vessel owner in order to land his/her quota.

The industry proposes that fishing rights should be granted as a perpetual usufruct. However, owners of a fishing right should be continually monitored so that, if necessary, an audit can be carried out from time to time to determine whether the performance criteria for ownership of a hake fishing right are being met in a satisfactory manner. If performance criteria are met, fishing rights will be renewed automatically. If the audit suggests that the performance criteria have not been met then the rights of the quota holder will be reviewed and the quota could be reduced or even taken away completely. The proposed performance criteria are:

- 1. compliance with a Code of Conduct regulating employment practices and social responsibilities**
- 2. ownership of adequate trawling capacity**
- 3. full utilisation of the commercial catch**
- 4. support for research and development**
- 5. use of local facilities and manpower**
- 6. provision of secure non-seasonal formal employment**
- 7. strict adherence to fishing regulations**
- 8. Fishing rights should be divisible and freely transferable. The sale of quota should not be subject to approval by any political or bureaucratic authority.**