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TOOLS FOR FISHING FLEET MANAGEMENT

STUDY

EN DE ES FR IT

2009

EUROPEAN PARLIAMENT

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POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

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STUDY

This document was requested by the European Parliament's Committee on Committee on Fisheries.

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LINGUISTIC VERSIONS

Original: EN
Translation: DE, ES, FR, IT.

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Manuscript completed in March 2010.

This document is available on the Internet at:
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Abstract

This briefing document focuses on the basic principals of fleet capacity and capacity management and examines how fleet capacity is managed in a number of non-EU countries; Australia, New Zealand, Canada, United States of America, Norway and Iceland. It aims at providing a support tool for the Members of the EP's Committee on Fisheries providing knowledge on instruments for fishing fleet management as used in different non-EU countries in comparison with the EU fishing fleet management scheme.

IP/B/PECH/IC/2009-90 March 2010

PE 431.599 EN

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LIST OF ABBREVIATIONS

ACE	Annual Catch Entitlement
AFMA	Australian Fisheries Management Authority
AFS	Aboriginal Fisheries Strategy
BSF	Build Sustainable Fisheries
CFP	Common Fisheries Policy
DFO	Department of Fisheries and Oceans
EA	Enterprise Allocation
EEZ	Exclusive Economic Zone
EFF	European Fisheries Fund
FAO	Food and Agriculture Organisation of the United Nations
FIA	NZ Fishing Industry Association
FIB	NZ Fishing Industry Board
FIFG	Financial Instrument for Fisheries Guidance
FMA	Fisheries Management Areas
GT	Gross Tonnage
ICES	International Council for the Exploration of the Sea
IEQ	individual effort quotas
IPOA	International Plan Of Action
IQ	Individual Quota
ITE	Individual Transferable Effort
ITQ	Individual Transferable Quota
IVQ	Individual Vessel Quota
kW	Kilo Watt

LAPP Limited Access Privilege Program

MAC Management Advisory Committee

MAF Ministry of Agriculture and Fisheries

MAGP Multi-Annual Guidance Programme

MPA Marine Protected Area

MSFCMA Magnuson–Stevens Fisheries Conservation and Management Act

MSY Maximum Sustainable Yield

NOAA National Oceanic and Atmospheric Administration

OCS Offshore Constitutional Settlement

QMS Quota Management System

SESSF Southern and Eastern Scalefish and Shark Fishery

SFA Sustainable Fisheries Act

STECF Scientific, Technical and Economic Committee on Fisheries

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EXECUTIVE SUMMARY

Background

The briefing paper is conceived as a support tool for the Members of the EP's Committee on Fisheries providing knowledge of tools for fishing fleet management used in different non-EU countries (Australia, New Zealand, Canada, United States of America, Norway and Iceland), in comparison with the EU fishing fleet management schemes.

The aim of this study is to provide a quick overview of the application of tools for fishing fleet capacity management in the group of selected countries. The approach is to provide a short technical background for tools for fleet management. The experiences in the selected countries are used to compare practices with those of the EU fishing fleet management approach.

The methodology used in this study is based on the interpretation of publically available documents and data sources. With the aid of a number of country experts specific information sources have been indentified. A study of available literature on the principles of capacity management and fleet management instruments as well as on the particular application of management instruments in the countries included in this study (United States of America, Canada, Australia, New Zealand, Iceland and Norway) has been implemented. The nature of this study is one of providing a quick scan overview which may lead up to a more profound in depth study.

Synopsis

In 1999 FAO published its International Plan Of Action for the management of fishing capacity. Excessive fishing capacity is perceived as a problem that, among others, contributes substantially to overfishing, the degradation of marine fisheries resources, the decline of food production potential, and significant economic waste. One of the main challenges for the current CFP reform and future fisheries policy is addressing this deep-rooted problem of fleet overcapacity.

Defining and measuring fishing capacity

Fishing capacity can be defined as the amount of fish or fishing effort that can be produced over a given period of time, and for a given resource condition, by a vessel or fleet, given the technology, fixed factors of production, no restriction on variable input usage, and customary and usual operating procedures. Overcapacity in a fishery than arises whenever the capacity of the fleet is higher than the minimum required to achieve a target level of sustainable exploitation of the fish stock.

In order to determine the amount of access capacity in a particular fleet a distinction between short term *excess capacity* and long run *overcapacity* needs to be made. In addition we need to render count of an input oriented analysis (how much can we fish given the existing input) and output oriented analysis (given the available resource or Total Allowable Catch how much input (capacity) is required).

In order to measure capacity it should be realised that capacity is a fisheries, fleet and hence metier specific phenomenon. In its 2007 Communication to the Council and the European Parliament, on improving fishing capacity and effort indicators under the common fisheries policy, the EU commission provides input to the debate on the most appropriate

way to quantify fishing capacity and fishing effort in the framework of the Common Fisheries Policy. According to the EU Commission, the characteristics, and especially the size, of fishing gear can be taken as representing the potential of a vessel to generate fishing mortality. If the type and size of the fishing gear that fishermen are allowed to use in a certain fishery are well defined, fishing capacity may be easier to quantify on the basis of that information. The capacity based on fishing gear characteristics comes next to the common practice to quantify capacity on the basis of vessel characteristics in which tonnage and engine capacity of the vessel are the two most commonly used indicators.

Managing fishing capacity

From a stock conservation perspective, the existence of excess capacity does not pose any threat provided that the total output of the fishery is constrained to a sustainable level. However, at the aggregate fishery level, the existence of excess capacity indicates a waste of economic resources, as, by definition, the same catch could have been taken with fewer boats operating at full capacity. Under such conditions, economic incentives exist that encourage fishers to exceed quota levels imposed, speed up the 'race to fish', and increase capitalisation in a bid to increase individual returns. Hence in fact overcapacity is much more of an economic problem than an ecological issue.

Instruments to manage fisheries capacity range from measures such as regulating entry to a fishery, gear and vessel restrictions, group fishing rights, territorial user rights, total allowable catches, vessel catch limits, individual effort quotas, individual transferable quotas, taxes and royalties to buyback and decommissioning schemes. These instruments used fall into three main categories: input controls, output controls and access charges. Input controls are those measures aimed at limiting fishing capacity by limiting or reducing the level of inputs used. Output controls aim at regulating the amount of fish landed. Access charges, such as management cost recovery and access and user charges, are an instrument directly affecting the economics of the fishing operation.

In the table below an overview of the classification of the different fisheries capacity management instruments is given. Also an indication is given of the countries in which these instruments are applied.

Classification of fisheries capacity management instruments and application in selected countries.

Typology	Instrument	As for example applied in
Input control	Unitisation schemes	Australia
	Effort limits and temporal and spatial closures	Canada, Australia, Iceland, Norway
	Licence limits	US, Canada, Australia, New Zealand, Norway
	Technical limits such as the type and size of gear used	Canada, Australia, Iceland, Norway, EU
	Entry/exit scheme	EU
	Decommissioning/buyback vessels, permits	US, Canada, Australia, Norway
Output Control	TAC	US, Canada, Australia, New Zealand, Iceland, Norway, EU
	Individual Quota (IQs) Fishing cooperatives, community quotas, area-based quota programs, vessel quota	US, Australia, Norway
	Transferable Quota (ITQs)/harvest rights	Canada, Australia, New Zealand, Iceland
Access charges	Management cost recovery	New Zealand

Country cases

The U.S.

In the United States (U.S.), the management of fishing capacity is recognized as a serious management problem that is deemed responsible for the overfishing of many domestic fish stocks. There are eight federal fishery management councils each regionally specialising in the fisheries under their jurisdiction because the stocks and the fishers are fairly unique to each region resulting in a situation in which different species of fish are managed by different entities for different purposes.

The main instruments utilised in U.S. fishing fleet capacity management are market-based management and dedicated access privileges, such as individual fishing quotas, fishing cooperatives, community quotas, and area-based quota programs; buybacks and buyouts removing fishing vessels and reducing capacity directly by means of a buyback of fishing vessels or permits; license limitation restricting the number and size of vessels that can

participate in a fishery; and conventional harvest restrictions, not directly reducing capacity, but limiting the ability of each vessel in the fishery to harvest fish.

Several examples of buyout programmes can be found in the U.S. In evaluating such programmes the conclusion is that although buyback programs can be used to target a capacity problem and produce an immediate and significant reduction in harvesting capacity, these programmes do not, by themselves, address the fundamental and underlying problem of economic incentives and, therefore, at best can result in only temporary reductions in excess harvesting capacity. Hence stand-alone buybacks are not perceived as an effective measure to prevent or eliminate excess harvesting capacity. Based on a comparative assessment of the cost-effectiveness, lasting results and legal and programmatic flexibility of various U.S. rationalisation programs over nearly two decades, the conclusions is drawn that market-based management has a strong track record for effectively and efficiently reducing excess harvesting capacity.

Canada

A major objective of Canadian fisheries policy is to ensure "that allocation of fishery resources will be on the basis of equity, taking into account adjacency to the resource, the relative dependence of coastal communities, and the various fleet sectors upon a given resource, and economic efficiency and fleet mobility". The choice of which measures to use depends upon species characteristics, specific fleet structure and location of a given fishery. Methods employed include regulating the type and size of gear used, vessel length, fishing times and areas, catch limits, limiting the number of licenses available to fish, and marketable harvest rights.

There are vessel replacement rules for all fleets to control growth of capacity. Limits on the quantity/dimension of gear or the amount of time a unit of gear that can be used are usually required as a licence condition for most fisheries.

In response to the resource downturns in the Atlantic ground fish and Pacific salmon fisheries licence buyback and early retirement programs as well as short-term income support, retraining and economic diversification to assist affected fisheries workers and communities have been introduced.

Market-like instruments have been introduced in some fisheries as a way to integrate capacity and catch control. In the case of Canada's Pacific fisheries licence limitation/limited entry schemes, combined with a total allowable catch was used to prevent the build up of excess capacity.

Australia

Australian Government policy with respect to fishery management is based on the principle that fisheries are a community owned resource. Fisheries management is shared between the Australian Commonwealth and the State Governments. A range of output and input based management techniques are applied to Commonwealth fisheries. Input controls include time based controls, such as seasonal closures; location based controls, such as area closures; entry based controls, such as licensing; and gear based controls, such as net limits and boat size limitations. Output controls include total allowable catches and individual transferable quotas. In most fisheries a combination of management mechanisms are applied involving limited entry, time and area based controls and either gear and/or output based mechanisms.

State Governments have the responsibility of administering Australia's fisheries within three nautical miles from the coast line. Most fisheries are managed using a variety of input controls although quota management systems are in place in a number of fisheries.

In 2006 a buyback programme intended to half the then existing Commonwealth fishing concessions was implemented. In the buyback programme the Government would buy the ''right to fish'' from the fishers. There was no requirement that a person relinquishing a fishing concession would exit fishing. Further, although Government would not decommission fishing boats, fisherman who would scrap a boat would receive a fixed amount. Approximately 34 percent of Commonwealth fishing concessions were removed in the buyback.

New Zealand

New Zealand's commercial fisheries are managed under a comprehensive Quota Management System (QMS). In order to implement the QMS system, the New Zealand EEZ was divided into ten Fisheries Management Areas. ITQs (Individual Tradable Quota) were specified as the individual perpetual right to a part of the fish harvest designated in metric tonnes for a particular species group to be taken from a specified quota management area (QMA). Each QMA comprised one or more Fisheries Management Areas, based on biological stock distributions.

The commercial fishing rights of the aboriginal Maori were settled in the Settlement Act 1992, which promised the Maori commercial fisheries 20% of the TAC for all new species brought into the QMS. The Act also established Maori customary fishing as a separate sphere of the fishing sector, with a priority right over and above any commercial and recreational allocation. The Act promised development of regulations for Maori customary fishing. The customary fishery is managed separately from the commercial fisheries by local guardians, appointed by the Maori tribes. They are obliged to deliver information about catches to the central government to facilitate resource assessments.

New Zealand's fishing fleet has reduced in size and become more efficient as a result of the Quota Management System. The quota system has eliminated an issue New Zealand faced in the 1970s of too many boats chasing too few fish. Back then, government subsidies and high export prices attracted more and more fishers with better boats and gear.

Iceland

Like in New Zealand the main instrument in fisheries and fleet management is a system based on Individual Tradable Quota (ITQs). During the past 15 years there has been no specific fleet management system in Iceland. Fishing licences are readily available for anyone with a seaworthy vessel. No decommissioning schemes are in place - all decommissioning has happened due to the ITQ system pushing companies to buy out vessels to increase their share of the TAC by buying the quota attached to vessels. Some inshore fishery has existed inside the ITQ system and also outside of it as controlled artisan fishery based on number of fishing days/boat.

In addition to the ITQ system, Icelandic fisheries management includes many other management measures such as area restrictions, fishing gear restrictions, and the use of closed areas to conserve important vulnerable habitats. Extensive provisions are made for temporary closures of fishing areas to protect spawning fish from all fishing.

Over the period 1999-2008 the Icelandic fishing fleet has decreased by some 23% in number of vessels, 12% in total gross tonnage and some 7% in total engine capacity. In interpreting the size of the Icelandic fishing fleet it should be noted that not all registered fishing vessels participate in the Icelandic fisheries. Some simply lie idle. Some do not have a fishing license in Icelandic waters but are applied on distant fishing grounds or, in the case of the undecked vessels, used as recreational vessels.

Norway

From ancient times regulatory measures have been used in Norwegian fisheries. During most of the time these measures had a local and distributive character, e.g. reserving certain areas for specific gear. It is only in the last century that regulatory measures have been based on biological considerations. The first nationwide regulations were mainly restricted to regulations on ownership of fishing vessels and of licences to fish. Only at a later stage were regulations used explicitly to reduce fishing activity.

The output regulations in Norwegian fisheries management entails setting species TACs resulting in a national species quota for the Norwegian fishing fleet. The Norwegian TACs are split into group quotas, which correspond to the different groups of vessels. Individual Vessel Quota (IVQ) are fixed for each participating vessel holding a license or annual permit, which guarantees them a fixed proportion of the group quota. IVQs mainly apply to vessels with permits or licenses. Maximum Quota are allocated to coastal vessels in open access fisheries, also called Olympic quota. Once the group quota has been reached, fishing is stopped, regardless of whether each vessel has reached its Maximum Quota. This system is used in groups where the efficiency of vessels varies widely and includes many small vessels. Groundfish quota mainly regulates coastal vessels using conventional gear, rather than trawlers. Quota combining the quotas from cod, haddock and saithe from each vessel participating.

In addition, fisheries management instruments used in Norway are limitation of access through licensing, and technical regulations such as a discard ban and closed areas. For the management of fishing capacity several instruments are adopted; input regulations (to limit the fishing effort), structure regulations (to limit fishing capacity in a number of vessel groups) and output regulations (to limit the allowable catch). Although there is still open access to Norwegian fisheries for small fishing vessels using passive gear, in practice an increasing number of fisheries are regulated with access limited to vessels, or vessels owners, with historical track records. Licenses represent a right to participate in a fishery. They are attached to a vessel and an owner and may only be sold with a vessel or transferred to a new vessel under the current owner after an application to the fishing authorities.

Norway uses decommissioning schemes as an instrument to reduce the fishing fleet. Various schemes have been in effect more or less continuously for the last 40 years. Approximately 3,500 vessels have been removed through decommissioning grants. Previously, the focus of this scheme was modernisation, but now the aim is reduction of the fleet capacity. Grants for constructing new vessels are no longer given.

Market-like instruments have been introduced with the general idea to reduce the number of vessels in a certain vessel group where fishing capacity is considered to exceed current and future TACs.

EU Fleet capacity management

Fisheries management under the CFP entails a mix of approaches and instruments, including input controls (e.g. gear restrictions) and output controls (e.g. quotas). Stocks in the North East Atlantic in particular have primarily been managed on the basis of Total Allowable Catches (TACs). In recognition of the fact that TACs have been insufficient to conserve fish stocks, they are being increasingly complemented by effort restrictions.

In recent years the Common Fisheries Policy (CFP) has undergone a number of changes. Fleet capacity targets, set by fleet segment, were replaced with a rules-based fleet management system. The 2002 CFP reforms led to a shift away from setting national fleet segment target sizes centrally at the EU level, to establishing a rules based system and placing

greater responsibility for fleet management with the Member States. The system is now based on a cap on national fleet sizes and vessel entry/exit rules.

Discussion

Looking at the non-EU countries, in all cases the management of the fishing fleet and in particular the fishing capacity is perceived as a priority. All countries apply a mixture of input controls and output controls. In all country cases a leading conservation management principle is the setting of total allowable catches. In addition a variety of market-like instruments have been introduced as instrument for fleet capacity management.

In the case of the U.S., Canada and Australia specific buyback schemes, at times accompanied with decommissioning schemes, have been deployed. As stand alone instrument buyback schemes prove to be of little assistance in reducing fishing capacity. In fact buyback schemes usually are part of an array of fishing fleet management instruments such as taxes, permits, licenses, market and rights based management, individual transferable quotas, technical measures and limitations on access or gears.

Especially for the larger countries, with many different fishing regions and differing fishing fleets, we see the development of a management set up and mix of fisheries management instruments tailored to the regional characteristics. This also includes the possibility to establish specific management arrangements for local, traditional rights and practices.

As for the European Union, with its mix of input and output measures under the CFP, it fits in with the general fisheries management practices across the globe. What should be considered, noticing the positive experiences in other countries, is the application of market-based instruments such as tradable quota.

As for the effectiveness of the application of the several fleet capacity management instruments, a first conclusion must be that each instrument has to be analysed in its proper setting. This implies that the instrument for fleet capacity management is usually embedded in a wider set of fleet and fishery management regulations. Hence no instrument can be singled out as a stand alone tool to fully manage fishing capacity. Secondly, the instruments deployed should be analysed in the context in which they are being used. This means analysing the instrument against the characteristics of the specific fleet and fisheries. Thirdly, the effectiveness of a single instrument is embedded in the wider outcome of the fisheries management system.

Having said this, overall the conclusion must be that over the past decade in the countries studied fleet capacity has been reduced. Hence the suite of instruments applied have been successful in managing fishing capacity. However, in the majority of cases still available fishing capacity is perceived to be not in line with available fishing opportunities.

A distinction should be made between those instruments physically limiting capacity (technical measures, limitations on engines, vessel size, gear restrictions) and those instruments limiting the deployment of the capacity (effort restrictions, catch restrictions). For those instruments limiting overall capacity it should be noted that over time, for example as a result of technological development, the fishing capacity of the remaining physical capacity can alter. As for the management of the deployment of capacity, the use of tradable fishing quota is used in many countries and, for example in Iceland, New Zealand and in some countries of the EU has been an effective instrument in bringing capacity in line with available quota.

Overall, deployment of capacity is managed in the frame of a Total Allowable Catch. Technical restrictions, although in cases easy to circumvent, further structure the deployment of

the capacity. Market-like instruments appear to be effective in fleet restructuring. Cost recovery, as for example deployed in New Zealand, transfers management costs from society to the actual user groups.

A special case is formed by decommissioning and buyback schemes. In the case of the U.S., Canada and Australia specific buyback schemes, at times accompanied by decommissioning schemes, have been deployed. Overall the modalities of such systems consist of government making available a maximum budget for buying back licences. In cases, but not always, an additional facility is available for either the scrapping of the vessel related to the licence, of for providing a new destination for the vessel, either in a different sector or in a different geographical area.

Buyback subsidies have several disadvantages. First, buyback programs at best remove only less efficient vessels. Second, additional capacity may gradually seep back into the fishery through upgrading of the remaining fleet. Thirdly, buybacks may come to be anticipated by fishermen which leads to greater overcapacity than would otherwise occur.

Based on the Norwegian experiences, in which the profitability of the remaining vessels increased due to the decommissioning programs, the question can be raised whether the industry could have financed the buy-backs itself, through the buying and selling of fishing rights. Such a scheme of buyback has been developed in the US.

Hence as stand alone instrument, buyback schemes prove to be of little assistance in structurally reducing fishing capacity. In fact, buyback schemes usually are part of an array of fishing fleet management instruments such as taxes, permits, licenses, market and rights based management, individual transferable quotas, technical measures and limitations on access or gears. Although helpful in a one-off reduction of capacity, overall these buyback programmes are inefficient in long term fleet capacity management and do not address the economic incentive driving capacity development.

In conclusion each set of capacity management instruments has to be tailored to the characteristics of a specific fishing fleet. Main lesson drawn is the consideration of applying market based instruments in fleet capacity management. On the other hand the consideration that overcapacity is much more of an economic concern than that of a conservation issue; with a proper monitoring and control of output regulating instruments the size of neither the fleet nor its potential fishing capacity matters, but the way the capacity is deployed.

1. INTRODUCTION

In evaluating the Common Fisheries Policy the European Commission draws the conclusion that one of the main challenges for the current CFP reform and future fisheries policy is a deep-rooted problem of fleet overcapacity (Commission of the European Communities, 2009 p 8). Excessive fishing capacity is a problem that, among others, contributes substantially to overfishing, the degradation of marine fisheries resources, the decline of food production potential, and significant economic waste (FAO, 1999).

Today the EU fleet is managed through what is known as the 'entry/exit' scheme. This lays down a few simple principles, which are designed to ensure that the capacity of the fleet in tonnage cannot rise above the level of 1st of January 2003 (European Communities, 2009). This cap on fleet capacity is complemented by an obligation for Member States to adapt the capacity of their fleets to the resources available whilst taking into consideration technological creep, through which the same tonnage comes to mean more fishing power over time (European Communities, 2009). The Commission has concluded that while EU fishing capacity overall is declining, the reduction is coming too slowly (on average, an annual reduction of 2-3% over the last 15 years) for it to have any substantial impact on fishing pressure and thus alleviate the poor state of many EU fish stocks, in particular demersal stocks. It is estimated that technological creep runs at around 2-4 % annually, thus effectively cancelling out any nominal reduction.

The methodology used in this study focuses on the interpretation of publically available documents and data sources. With the aid of a number of country experts specific information sources have been indentified. A study of available literature on the principles of capacity management and fleet management instruments as well as on the particular application of management instruments in the countries included in this study (United States of America, Canada, Australia, New Zealand, Iceland and Norway) has been implemented. The nature of this study is one of providing a quick scan overview which may lead up to a more profound in depth study.

In this briefing document we will start by looking at the more theoretical aspects of fishing fleet management, and more in particular issues surrounding the measurement and management of capacity, and the framework for fleet capacity management as represented by the FAO International plan of action for the management of fishing capacity. In section three we will look at some experiences with fishing fleet capacity management outside the EU. In section 4 we will look into EU Fleet capacity management. Finally in the last section we will discuss these findings and draw some conclusions and recommendations.

2. CAPACITY AND FLEET MANAGEMENT

Where in the early stages of the EU Structural Policy fleet capacity was considered to be merely a socio-economic issue, the target capacities gradually became more and more connected with the stock Conservation Policy. Reducing overcapacity thus became an extra instrument, besides TACs and quotas, in the struggle to reduce overfishing of the common fish stocks (van Hoof and de Wilde, 2005). Within the EU, capacity management has been attempted through Multi-annual Guidance Programmes (MAGPs) which sought to encourage a sustainable balance between the capacity of the EU fishing fleets and the available resources by first stabilising and then removing capacity from the fishery. This approach has been warranted as a result of the general failure of management to effectively deal with the underlying reasons for excess capacity and continued declines in many important commercial fish stocks (Lindebo, 2005).

In the 2002 reform of the Common Fisheries Policy it was stated that one of the most fundamental and enduring problems of the Common Fisheries Policy has been the chronic overcapacity of the EU fleet. Conservation measures have persistently been undermined by fishing activities at levels well beyond the level of pressure that the available fish stocks could safely withstand (Commission of the European Communities, 2003). As new technology makes fishing vessels ever more efficient, the capacity of the fleet should be reduced to maintain a balance between fishing capacity and the quantities of fish that can safely be taken out of the sea by fishing. This is what the EU has long been trying to do. Four Multi-Annual Guidance Plans were established to achieve this aim by setting, for each coastal Member State, maximum levels of fishing capacity by groups of vessels. However, MAGPs failed to meet expectations and proved cumbersome to manage. This is why MAGP IV, which ended in December 2002, has been replaced by a simpler entry-exit scheme.

Under the new scheme for the fleet, capacity will gradually be reduced. From now on, the introduction of new capacity into the fleet without public aid must be compensated by the withdrawal of at least an equivalent capacity also without aid. In order to ensure that the ability to fish is not simply transferred from a vessel being scrapped to others remaining active, the fishing licences and, in certain cases, authorisations of vessels decommissioned with public aid will have to be returned to the national authorities concerned (Commission of the European Communities, 2003).

Before we go in more detail into the instruments of capacity management we will first address the issue of defining and measuring fishing capacity.

2.1. The FAO International plan of action for the management of fishing capacity

In 1999 FAO published its International Plan Of Action (IPOA) for the management of fishing capacity (FAO, 1999). The FAO Code of Conduct for Responsible Fisheries (FAO, 1995) stipulated the necessity for States to take measures to prevent or eliminate excess fishing capacity and should ensure that levels of fishing effort are commensurate with sustainable use of fishery resources. The voluntary IPOA aimed at an efficient, equitable and transparent management of fishing capacity.

The IPOA for the management of fishing capacity aims at the establishment of:

- a global assessment of capacity;
- developments of national plans for the management of capacity;
- improved capability for the management of fishing capacity; and
- immediate actions for major transboundary, straddling, highly migratory and high seas fisheries requiring urgent measures.

Basis of capacity management is the understanding of capacity issues, among which the definition and measurement of capacity. The IPOA for the management of fishing capacity prescribes States to assess their fleet's capacity, develop national records of fishing vessels and develop the means to monitor the implementation of fisheries capacity management plans. In particular States should eliminate all factors, including subsidies and economic incentives and other factors which contribute, directly or indirectly, to the build-up of excessive fishing capacity. In 2002 FAO published a report on an expert consultation on catalysing the transition away from overcapacity in marine capture fisheries, seeking to operationalise the IPOA.

2.2. Defining fishing capacity

According to the FAO (Metzner, 2005) in fisheries the term 'capacity' is related to several issues that reflect the relationship between the concept of capacity, the harvesting of fish by fishing vessels, and the biological concept of fishing mortality; the concepts of *excess capacity*, *overcapacity*, *overfishing* and *overcapitalisation* are closely related, yet different. In technical terms fishing capacity relates to the 'fishing power' of a vessel; "capacity" than includes such things as gear size, boat size, and engine capacity. A difficulty with such a physical definition is that it focuses on the inputs used to catch fish rather than the output of fish and fishing effort and may create a misleading impression of what is happening to true capacity. For instance, where engine power is controlled, fishers can increase the power of their vessels in other ways, thereby substituting one input for another and increasing capacity in the fishery.

For fisheries biologists, "capacity" is often thought of in terms of fishing effort and the resultant rate of fishing morality (the proportion of a fish stock that is killed through fishing). For fisheries managers, "capacity" may be linked to the number of vessels operating in a fishery or in terms of the gross tonnage of a fleet, total effort such as standard fishing days, or even the rate of vessel utilisation.

In contrast, economists define capacity either in terms of inputs (what is used in production) or in terms of outputs (what is produced). In input terms, the economic definition of capacity can be considered as the minimum fleet and effort required to produce a given total allowable catch or given output (harvested catch) level. In output terms, capacity can be considered as the maximum harvest level that a fisherman or a fleet can produce with given levels of inputs, such as fuel, amount of fishing gear, ice, bait, engine horsepower and vessel size. As a result, the economic term "overcapacity" also can be described in two ways. In input terms, "overcapacity" means there is more than the minimum fleet and effort required to produce a given TAC or given output (harvested catch) level. Alternatively, in output terms, overcapacity means that the maximum harvest level that a fisher could produce with given levels of inputs, such as fuel, amount of fishing gear, ice, bait, engine horsepower and vessel size would exceed the desired level of harvesting or TAC.

With this in mind, FAO defines fishing capacity as the amount of fish or fishing effort that can be produced over a given period of time, and for a given resource condition, by a vessel or fleet, given the technology, fixed factors of production, no restriction on variable input usage, and customary and usual operating procedures. Overcapacity in a fishery, following OECD, then arises whenever the capacity of the fleet is higher than the minimum required to achieve a target level of sustainable exploitation of the fish stock (OECD, 2009). Assuming that the target level is determined with respect to maximum sustainable yield (MSY), overcapacity indicates that the fleet size is larger than required to harvest MSY.

Surplus capacity can be defined in terms of excess capacity and overcapacity. ***Excess capacity*** is a short run phenomenon that occurs when a firm produces less than it could under normal operating conditions because of a change in market conditions for input costs, output prices, or, in the case of the fishery, the fish stock abundance; whilst ***overcapacity*** is a long run phenomenon that exists when the potential output that could exist under normal operating conditions is different from a target level of production in fishery such as maximum economic yield or maximum sustainable yield (Ward and Metzner, 2002).

In order to measure capacity it should be realised that capacity is a fisheries, fleet and hence metier specific phenomenon. In its 2007 Communication to the Council and the European Parliament, on improving fishing capacity and effort indicators under the common fisheries policy (Commission of the European Communities, 2007b), the EU commission provides input to the debate on the most appropriate way to quantify fishing capacity and fishing effort in the framework of the Common Fisheries Policy. According to the EU Commission, the characteristics, and especially the size, of fishing gear can be taken as representing the potential of a vessel to generate fishing mortality. If the type and size of the fishing gear that fishermen are allowed to use in a certain fishery are well defined, fishing capacity may be easier to quantify on the basis of that information. The capacity based on fishing gear characteristics comes next to the common practice to quantify capacity on the basis of vessel characteristics in which tonnage and engine capacity of the vessel are the two most commonly used indicators.

Assessing overcapacity is of critical importance because overcapacity is a harmful, long run phenomenon that does not self-correct itself and will persist indefinitely if not addressed (Metzner, 2005). In contrast, excess capacity - the difference between what a production facility could produce if fully utilized and what is produced by the owners, given the prices of inputs and outputs - is a common, short run phenomenon in all types of industries at different points in time. In fisheries, lower prices or temporarily higher costs (e.g. fuel price increases) may result in boats operating less than expected under average conditions. If the prices and costs return to normal levels, this excess capacity is self correcting. Excess capacity can also be caused by fisheries management. If stock recovery programmes impose restrictions on catch or effort that result in the vessels being underutilised during the recovery process, but later allow vessels to be fully utilised when the stocks have recovered, then the excess capacity will not be problematic. However, if the effort or catch restrictions are likely to persist into the future, then it is likely that excess capacity is actually an indicator of overcapitalisation in the fishery (Metzner, 2005).

Related to overcapacity is overcapitalisation – the situation in which a smaller fleet (in terms of vessels and employment) could produce the same amount of fish and in a more efficient way (Brandt and McEvoy, 2006). With the appearance of overfishing and resulting declines in stock abundance, overcapacity develops in a fishery when the net benefits to the fishing fleet begin to decline (Metzner, 2005).

2.3. Measuring fishing capacity

In order to determine the amount of access capacity in a particular fleet we have seen above that we need to distinguish between short term excess capacity and long run overcapacity. In addition we need to render count of an input oriented analysis (how much can we fish given the existing input) and an output oriented analysis (given the available resource (TAC) how much input (capacity) is required. In this respect we have to focus on both the analysis of the individual vessel as on the fleet as a whole.

Moreover, capacity of a fishing boat, can be described as its potential output, given its fixed factors of production (van Hoof and de Wilde, 2005). These fixed factors are those

that cannot be changed in the short run (in a boat, for example, its size or engine power). Differences in output between similar vessels can be due to either differences in 'capacity utilisation' or differences in 'technical efficiency.' For example, differences in the catch of two boats of the same size may be due to a difference in the number of days fished (utilisation of available capacity), or a difference in the ability of the skipper in harvesting the resource (technical efficiency). In order to determine the potential output of a boat under normal operating conditions, these effects need to be separated out.

In terms of measurement according to Ward and Metzner, (2002), the level of capacity utilisation can be measured in a fishery both in indicative or qualitative terms and in analytical or quantitative terms. While quantitative metrics might be preferred, indicative measures are exceedingly practical in providing a first glimpse of the status of a fishery. A combination of indicators utilising time trend information is needed to determine qualitative capacity levels in fisheries (Ward and Metzner, 2002). Indicators that could be used are for example the biological status of the fishery, catch per unit of effort and total catch levels and the existence of latent capacity. For the more quantitative assessment of fleet capacity there are tools such as peak-to-peak analysis, stochastic production frontier analysis and data envelopment analysis. The latter, being the preferred tool by FAO (FAO, 2002) has during the early 2000s been applied to a series of EU fleets (Vestergaard (coordinator) *et al.*, 2002).

For an indicative assessment of EU fleet capacity the annual report of the European Commission and the STECF work on developing biological, economic and societal indicators capable of assessing 'balance' between fishing capacity and available resources could provide a useful instrument. Article 11 of Council Regulation (EC) No 2371/2002 stipulates a key obligation in the system of the Community Fisheries Policy, namely that Member States (MS) shall take fleet capacity adjustment measures in order to achieve a stable and enduring balance between their fishing capacity and fishing opportunities. For facilitating the monitoring of their performance in fulfilling this obligation, MS have to submit to the Commission annually a report on their efforts undertaken in the previous year (see Art. 14 of the same Regulation).

Under the auspices of STECF a set of indicators for the balance between fishing capacity and fishing opportunities have been developed. Economic (fleet-based) indicators proposed are the return on investment and the break-even revenue/current revenue ratio; the biological (stock-based) indicators concern the current fishing mortality/target fishing mortality Ratio and the catch per unit of effort; social indicators entail the gross value added and the crew salaries as ratio of minimum or average wage (Commission of the European Communities, 2007a).

The above set of indicators are in combination with data collected by the EU Member States, a practical tool and gauge whether a balance is being achieved between capacity and fishing opportunities. One should bear in mind however that output-based measures of capacity imply comparing actual levels of landings/catches/removals against target levels. This is probably the most useful approach but crucially requires a methodology for estimating capacity according to this definition, as well as a reliable monitoring system. Capacity measures defined in terms of nominal effort (e.g. engine power, gross tonnage) require some idea of the relationship between effort and fishing mortality. Moreover, the economic, biological and societal indicators should not be evaluated in isolation.

In the box below capacity indicators for fishing gear as presented by the EU Commission (Commission of the European Communities, 2007b) are presented. The characteristics, and especially the size, of fishing gear can, according to the Commission's communication, be taken as representing the potential of a vessel to generate fishing mortality. If the type and

size of the fishing gear that fishermen are allowed to use in a certain fishery are well defined, fishing capacity may be easier to quantify on the basis of that information. The capacity based on fishing gear characteristics is put next to the common practice of quantifying capacity on the basis of vessel characteristics in which tonnage and engine capacity of the vessel are the two most commonly used indicators.

Box: Capacity indicators for fishing gear

Fishing capacity indicators for trawls
Trawling essentially consists of filtering water. Assuming an optimum trawling speed depending on the targeted species, the surface opening of the net measured in square metres (m^2) gives a reasonable quantification of fishing capacity.
Demersal and pelagic trawling could both be characterized by the surface opening described above. Beam trawls may be characterized by the length of the beam, which determines the surface of the opening for this type of trawl.

Fishing capacity indicators for longlines
The fishing capacity of longlines may be quantified by the number of hooks or, if the distance between hooks is kept constant, by the length of the longline.

Fishing capacity indicators for seines
The capacity of purse seines may be characterised by the total length of the net, the depth of the net being characteristic of the target species. Attention should be paid to the use of fish aggregating devices (FAD), which may increase capacity to an extent difficult to quantify. Seines are always attached to the vessel.

Fishing capacity indicators for pots
The capacity in a pot fishery may be quantified by the number and size of pots. Other characteristics of pots, such as their shape, the size of the openings and certain specifications on the materials used, would very much depend on the particular fishery and could be defined as technical measures.

Fishing capacity indicators for gillnets and trammel nets
The fishing capacity of these nets is directly related to their size, so the number of nets, together with their length and depth, would be appropriate capacity indicators. Surface area per net could also be used instead. Mesh sizes and other characteristics are specified as technical measures.

Source: Commission of the European Communities, 2007b

2.4. Managing fishing capacity

If we take the definition of 'capacity' as used in most industries, it refers to the potential output of the industry or a firm if all factors of production (e.g. capital and labour) were fully utilised. Full utilisation in this context means normal, but unrestricted use. 'Normal use' allows for non-productive time that is normally expected within the industry e.g. breakdowns. In the fisheries context, this would be equivalent to the potential catch of the industry (or firm) if all boats were fully utilised, allowing again for normal non-productive time. Excess capacity exists if the potential output exceeds the current output, indicating capacity under-utilisation (Pascoe *et al.*, 2002). Following Pascoe *et al.*, (2002), from a pure stock conservation perspective, the existence of excess capacity does not pose any threat provided that the total output of the fishery is constrained to a sustainable level. However, at the aggregate fishery level, the existence of excess capacity indicates a waste of economic resources, as, by definition, the same catch could have been taken with fewer

boats operating at full capacity. Under such conditions, economic incentives exist that encourage fishers to exceed quota levels imposed, speed up the 'race to fish', and increase capitalisation in a bid to increase individual returns. Hence in fact overcapacity is much more of an economic problem than an ecological. The alternative to increasing investment to maintain catch shares under such a scenario is to exit the fishery. However, the lack of alternative uses of fishing vessels makes exiting the fishery difficult (Pascoe *et al.*, 2002).

Today there is quite some experience with fisheries capacity management ranging from measures such as regulating entry to a fishery, gear and vessel restrictions, group fishing rights, territorial user rights (TURFs), total allowable catches (TACs), vessel catch limits, individual effort quotas (IEQs), individual transferable quotas (ITQs), taxes and royalties to buyback and decommissioning schemes (FAO, 2002; Pascoe *et al.*, 2002; OECD, 2009). Instruments used fall into three main categories: input controls, output controls and access charges. Input controls are those measures aimed at limiting fishing capacity by limiting or reducing the level of inputs used. Examples are unitisation schemes as for example deployed in the UK and Australia, in which a number of 'units' is allocated to a vessel based upon their physical characteristics or gear units in static gear fisheries. Other examples are effort limits, transferable effort quota and decommissioning and buy back schemes.

The success of input controls is often impeded by difficulties in defining the relationship between inputs and outputs. Further, technological change and input substitution force a continual reduction in input levels in order to maintain target levels of output and often result in a complex set of measures that reduce the efficiency of the individual fishers (Pascoe *et al.*, 2002).

Output controls aim at regulating the amount of fish landed. The most commonly known and applied are TACs and Individual and Transferable quota such as Individual Quota (IQs) and Individual Transferable Quota (ITQs).

Access charges are an instrument directly affecting the economics of the fishing operation. Examples are management cost recovery and access and user charges; the latter are common good for foreign fishing fleets exploiting a stock within a country's EEZ.

In the table below an overview of the classification of the different fisheries capacity management instruments is given. Also an indication is given of the countries in which these instruments are applied.

Table 1: Classification of fisheries capacity management instruments and application in selected countries.

Typology	Instrument	As for example applied in
Input control	Unitisation schemes	Australia
	Effort limits and temporal and spatial closures	Canada, Australia, Iceland, Norway
	Licence limits	US, Canada, Australia, New Zealand, Norway
	Technical limits such as the type and size of gear used	Canada, Australia, Iceland, Norway, EU
	Entry/exit scheme	EU
	Decommissioning/buyback vessels, permits	US, Canada, Australia, Norway
Output Control	TAC	US, Canada, Australia, New Zealand, Iceland, Norway, EU
	Individual Quota (IQs) Fishing cooperatives, community quotas, area-based quota programs, vessel quota	US, Australia, Norway
	Transferable Quota (ITQs)/harvest rights	Canada, Australia, New Zealand, Iceland
Access charges	Management cost recovery	New Zealand

3. COUNTRY CASES

3.1. United States of America

In the United States (U.S.), the management of fishing capacity is recognized as a serious management problem that is deemed responsible for the overfishing of many domestic fish stocks. The necessity to reduce fleet capacity has been cited by the Assistant Administrator for Fisheries as one of the two major problems facing U.S. fisheries management. The problem must be resolved within a complex management environment that involves many management entities and different management goals and objectives established by Congress and state legislatures (FAO, 2002).

Established under the Magnuson–Stevens Fisheries Conservation and Management Act (MSFCMA; first enacted in 1976 and amended in 1996) there are eight federal fishery management councils each regionally specialising in the fisheries under their jurisdiction because the stocks and the fishers are fairly unique to each region resulting in a situation in which different species of fish are managed by different entities for different purposes. A review of 77 fisheries indicated that over fifty percent of these fisheries had indications of overcapacity (FAO, 2002). The fishery management councils will determine what management actions they need to adopt to resolve the overcapacity problem in each fishery relative to the numerous management objectives that have been specified for each specific fishery.

Figure 1: U.S. fisheries management areas

Nationally the Magnuson-Stevens Fishery Conservation and Management Act contains several provisions related to capacity reduction in U.S. fisheries. For example, the 1996 revision of the Act mandated studies of the effect of government policies on capital investment and fishing capacity, and the effectiveness of buyout programs in reducing fishing capacity; placed a five-year moratorium on the issuance of new government loans for fishing vessel construction; proposed the creation of a standardized fishing vessel registration and information management system; and ordered the creation of a Capacity Reduction and Financing Authority to guarantee debt obligations incurred in capacity reduction (National Fisheries Conservation Centre, 2010) the latter two apparently still in the process of being established.

In 1996, Congress passed the Sustainable Fisheries Act (SFA), which changed the Magnuson Act into the Magnuson – Stevenson Fishery Conservation and Management Act (MSFCMA) (May, 2008). The Sustainable Fisheries Act provided the National Oceanic and Atmospheric Administration (NOAA) with expanded authority for implementing fishing capacity reduction programs: "to obtain the maximum sustained reduction in fishing capacity at the least cost and in a minimum period of time" (Ward, 2000). It mandated a study completed in the summer of 1999 on the role of the Federal Government in subsidizing the expansion and contraction of fishing capacity, and otherwise influencing the aggregate level of capital investment in fisheries. The SFA is also the primary factor behind the inclusion of capacity management as a formal NOAA planning objective. Under the Build Sustainable Fisheries (BSF) element of the NOAA Fisheries Strategic Plan, a 20 percent reduction in the number of overcapitalized fisheries was to be obtained. This planning element gives NOAA, for the first time, a quantitative capacity management target and a deadline (Ward, 2000).

The main instruments utilised in U.S. fishing fleet capacity management are (National Oceanic and Atmospheric Administration, 2008):

1. *Market-Based management* and dedicated access privileges, such as individual fishing quotas, fishing cooperatives, community quotas, and area-based quota programs.
2. *Buybacks and buyouts* removing fishing vessels and reducing capacity directly by means of a buyback of fishing vessels or permits, publicly and/or industry-funded. A more novel development is the financing of a buyback programme through other parties such as the 2006 example of the Nature Conservancy which funded a "conservation banking" scheme in Morro Bay, Monterey, Moss Landing, and Half Moon Bay in California and purchased seven federal ground fish trawl permits, leasing one permit back to a local fisherman, and, in the following year, concluded a Conservation Fishing Agreement with local fishermen[1].
3. *License limitation* restricting the number and size of vessels that can participate in a fishery.
4. *Conventional harvest restrictions* do not directly reduce capacity, but limit the ability of each vessel in the fishery to harvest fish; much of current marine fisheries management falls in this category, including area, seasonal, and gear restrictions, increasing costs and reducing revenues and, therefore, may have the cumulative effect of forcing some vessels out of the fishery.

In Table 2 the development of the fleet in number of vessels per region is presented. Over the period 1998-2000 the total fleet in number of vessels decreased with some 12%.

[1] Buyouts Financed by Other Private Organizations such as a conservation organisation. In this approach, vessel owners agree to sell their fishing vessels or permits, and a private entity agrees to buy and retire those fishing vessels or permits. In central California, The Nature Conservancy (TNC) funded a "conservation banking" scheme purchasing seven federal groundfish trawl permits in 2006, leasing one permit back to a local fisherman, and, in the following year, concluded a Conservation Fishing Agreement with local fishermen. It should be noted that this program is in its infancy, and, thus far, is arguably not a capacity reduction initiative. In fact, THC may substitute hook and line permits for the trawl permits in an effort to promote the wider use of an alternative harvesting technology. Therefore, the major objectives of this program are reduced bycatch and habitat protection, rather than capacity reduction (National Oceanic and Atmospheric Administration, 2008).

Table 2: Development of U.S. fishing fleet in number of vessels per region 1998-2002

	1998	1999	2000	2001
Northeast:	21,992	20,742	16,996	NA
South Atlantic and Gulf:	27,401	26,168	24,879	20,469
West Coast:	23,563	23,303	22,619	18,255
Total	72,956	70,213	64,494	NA

Source: National Oceanic and Atmospheric Administration, 1998-2002[2]

The U.S. Government Accounting Office evaluated the long-term effectiveness of three buyout programs in the United States (Government Accounting Office (GAO), 2000). A major objective of the GAO study was to evaluate ''the extent to which buyout programs have affected fishing capacity.'' The GAO studied vessel buyouts in the Northeast ground fish fishery, the Bering Sea ground fish fishery, and the Washington State salmon fishery. Between 1995 and 2000, the United States spend approximately U$130 million to reduce capacity in the three fisheries. The Northeast and Bering Sea capacity reduction programs removed vessels, while the Washington State salmon fishery buyout program removed permits. The buyout programs were designed with multiple goals such as reducing the capacity to harvest fish, providing economic assistance to fishers, and improving the conservation of fish. The GAO criticized the Bering Sea and Washington State buyout programs because National Marine Fisheries Service did not evaluate the programs or measure the capacity removed by the buyouts. The Northeast program was criticized because it allowed fishermen who were bought out to re-enter the fishery through the purchase of other vessels, primarily those that were inactive, and there were no measures in place to prevent inactive vessels from increasing their effort, thereby eroding conservation benefits. In all three cases, however, the potential conservation benefits of the buyout were not explicitly estimated before the programs were implemented. In Table 3 the development of commercial fishing permits in two selected US fisheries as described by the GAO evaluation, are presented. Both fisheries show a decline in total number of permits, the New England Ground fish Fishery 7%, the Washington State Salmon Fishery with 38%. In the analysis however the GAO report shows that the large reduction of salmon licenses is due to, in part, "by a 40-percent decline in salmon caught from 1994 through 1998 and a weakening international demand for salmon, which decreased the value of the fish caught. However, because the number of unused permits remains high, a reversal of these conditions would encourage these fishermen to use their permits" (Government Accounting Office (GAO), 2000). In both fisheries quite an extensive number of permits with zero catch remain as excess capacity as fishermen do not have to catch fish to maintain their permit. In 1998 38% of licenses in the New England Ground fish Fishery, and 59% in the Washington State Salmon Fishery registered zero catch (Government Accounting Office (GAO), 2000).

Table 3: Development commercial fishing permits in selected US fisheries

	1994	1995	1996	1997	1998	1999
New England Ground fish Fishery	NA	NA	1,763	1,776	1,649	1,645
Washington State Salmon Fishery	2,476	2,096	1,925	1,901	1,530	NA

Source: Government Accounting Office (GAO), 2000

[2] As of 2003 total number of vessels per region is no longer part of the Fisheries of the United States publication. Data for 2002 already show major gaps with data not being available.

Walden *et al*., (2003) further evaluated the Northeast buyout program. The Northeast ground fish fishery is a large and diverse fishery in the Northwest Atlantic. It is managed through a days at sea regime; a vessel has a fixed, non-transferable number of days per year it may fish. Most vessels are allocated 88 days per year, although some have been allocated as many as 164 days per year. Closed areas have been enacted, on both a year round and seasonal basis, to reduce fishing mortality and to protect spawning fish and juvenile fish aggregations. There is also a moratorium on entry of new vessels into the fishery. Vessels are only allowed a 1% upgrade in their physical characteristics based on a combination of gross tons, horsepower, and vessel length.

The Northeast buyout program was initiated in 1994 to help lessen the economic impacts generated by Amendments 5 and 7 of the Multispecies Plan. The primary purpose of the expanded Northeast buyout program was to reduce capacity in the Northeast ground fish fishery. Preliminary results at the time of the expanded buyout suggested that the purchased vessels represented 20% of the ground fish revenue reduced capacity by 9.9% of the total estimated capacity of 88,717 metric tonnes at a cost of U$18.6 million. This is substantially less capacity than the agency believed it had removed (Walden *et al.*, 2003).

In Table 4 the development of the Northeast fleet over the period 1996-2000 is presented. What is illustrated in Table 4 is a significant reduction in allocated days at see and in estimated fishing capacity (in terms of expected catch). The total number of permits remains rather stable over the period, de utilisation of allocated days at sea increases but remain sunder the 40%. Especially on this latter aspect, in the Northeast fisheries different categories of permits exist and the utilisation rates differed considerably across permit categories, ranging from 88% for Category A (individual days at sea - based on the vessel's history) to as low as 4% for Category D permit holders (hook-only - a limit of 4,500 hooks and fleet days at sea; vessels in this permit category can never change to another limited-access category). Across all permit categories after a slight decline in 1999, the upward trend continued through 2001, resulting in a utilisation rate of 34%. A large potential still exists for effort expansion in this sections of the multispecies fleet (National Marine Fisheries Service, 2002).

Table 4: Development of the US Northeast ground fish fleet

	1996	1997	1998	1999	2000	2001	2002
Total Number of Permits	3,435	3,787	3,525	3,694	3,858	4,741	3,525
Allocated Days-at-Sea	249,074	160,667	146,483	147,368	144,669	149,303	57,778
Estimated fishing capacity[1]	6,308	4,236	3,838	3,880	3,772	3,907	1,530
Fishing Year Days-at-Sea Utilisation	21 %	29%	34%	33%	37%	39%	NA

Source: National Marine Fisheries Service, 2002

[1] Estimated Fishing Capacity provides a measure of the maximum fishing capacity if the capital stock were fully utilised, defined in terms of expected catch (in 100,000-lb units).

In a more recent report to the U.S. congress (National Marine Fisheries Service, 2008) capacity and fleet management of 25 fisheries and 60 fleets were evaluated. Excess capacity and overcapacity rates vary considerably – among regions and fisheries, and among fleets and stocks within individual fisheries. For 12 out of 25 fisheries and 18 of 60 fleets, the ex-

cess capacity rate was approximately 50 percent or more in 2004. For 8 out of 23 fisheries, the overcapacity rate exceeded 30 percent in 2004.

The report estimates that, in a few years, there will be Limited Access Privilege Programs[3] (LAPP) and LAPP-like management programs in the large majority of regions. Based on experiences, especially in Alaska, the report concludes that buybacks may be useful if they are part of a larger capacity reduction program that either includes a LAPP or leads to a LAPP. However, although buyback programs can be used to target a capacity problem and produce an immediate and significant reduction in harvesting capacity, these programmes do not, by themselves, address the fundamental and underlying problem of economic incentives and, therefore, at best can result in only temporary reductions in excess harvesting capacity. Hence stand-alone buybacks are not perceived as an effective measure to prevent or eliminate excess harvesting capacity.

As for license limitation and harvest restrictions the report concludes that unless the rules to obtain and renew a permit, to upgrade a fishing vessel, and to transfer a permit to a replacement vessel are sufficiently restrictive, a license limitation program will not reduce capacity or capacity will tend to increase after any initial reduction. However, such a program can lead to a LAPP or LAPP-like program that will address the underlying management problem. Conventional harvest restrictions, which have been used to control both the level and use of harvesting capacity and to meet other management objectives, are often more effective in a management regime that includes a LAPP.

Based on a comparative assessment of the cost-effectiveness, lasting results, and legal and programmatic flexibility of various rationalisation programs over nearly two decades the report draws the conclusion that market-based management, including Limited Access Privilege Programs (LAPPs) and similar programs, has a strong track record for effectively and efficiently reducing excess harvesting capacity. Without well defined use rights, such as those that can be established with limited access privilege programs (LAPPs), the interests of individual fishermen are not aligned with the objective of sustainable fisheries and fishermen do not have sufficient incentives to support investments in the conservation and management of fishery resources.

Today the United States government is moving toward a co-management model to fishery governance based on stakeholder engagement. Community Development Quotas may serve as a platform for the empowerment of local communities and, as a result, the encouragement of sustainable fishing and development in coastal areas (May, 2008).

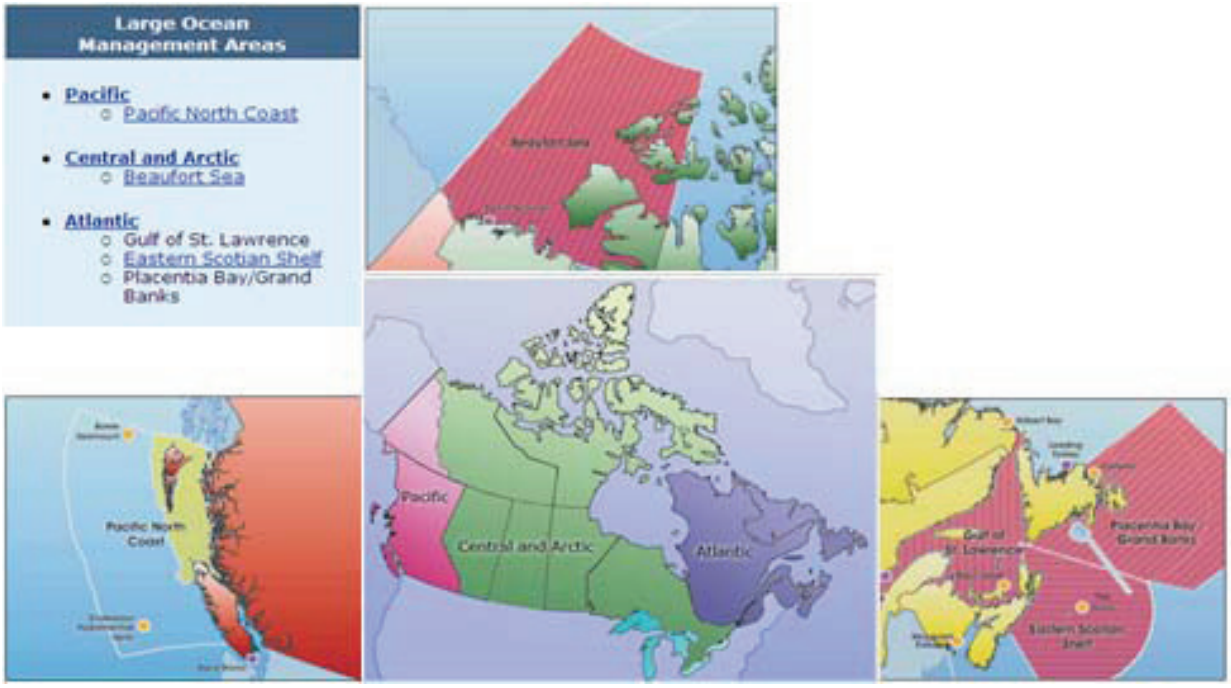
3.2. Canada

Canada's marine fishing industry operates on the Atlantic and Pacific coasts (FAO, 2010). On the Atlantic coast there were 43,831 full-time and part-time fishers in 1997. The Atlantic fishery consists of 22,643 offshore (greater than 19.8 m or 65 feet) and inshore (less than 19.8 m) vessels. Part of the offshore fleet consists of 106 large vessels(30.5 m or 100 feet and over), owned by a few vertically-integrated companies, and concentrates on ground fish, primarily along the Scotian Shelf, Grand Banks and Hamilton Bank. These vessels are highly specialized, mobile, capital-intensive units, operating year-round, depending on resource availability. In addition to the large vessels, which include stern and side

[3] Limited Access Privilege Programs (LAPP) are limited access systems whereby federal permits are issued to harvest a quantity of fish representing a portion of the TAC. The term, limited access privilege program, has recently been used in place of the terms, Individual Fishing Quota and Individual Transferable Quota, since this new term encompasses both individuals and communities who may be eligible to receive an allocation of a portion of the TAC or commercial quota (National Oceanic and Atmospheric Administration, 2008).

ground fish trawlers, the offshore fleet includes specialized intermediate-sized vessels, including herring seiners, scallop draggers and a smaller number of craft concentrating on offshore snow crab, lobster, shrimp and swordfish (Pitcher *et al.*, 2002).

Figure 2: Canadian fisheries management areas



A major objective of Canadian fisheries policy is to ensure "that allocation of fishery resources will be on the basis of equity, taking into account adjacency to the resource, the relative dependence of coastal communities, and the various fleet sectors upon a given resource, and economic efficiency and fleet mobility". The choice of which measures to use depends upon species characteristics, specific fleet structure and location of a given fishery. Methods employed include regulating the type and size of gear used, vessel length, fishing times and areas, catch limits, limiting the number of licenses available to fish, and marketable harvest rights (individual transferable quotas) (FAO, 2010).

Catch controls are the centrepiece of Canadian fisheries management. The Department of Fisheries and Oceans (DFO) establishes a Total Allowable Catch (TAC) or fishing effort for each fish stock, which is rigorously enforced. Over the past decade, DFO has introduced harvesting rights, often referred to as Individual Quotas or Enterprise Allocations, into a number of different fisheries. Under these programs, annual catch limits may change as a result of scientific advice, but access to a defined share of the resource remains the same for any quota holder (Fisheries Council of Canada, 2010).

All measures employ limited-entry licensing with vessel and gear restrictions to control fishing capacity, in combination with measures such as Total Allowable Catches (TAC) for most species, escapement targets (salmon), recruitment strategies (e.g. lobster) or trip/period limits to limit catches. Other commonly-used management measures include limitations on fishing area, fishing season, fish (or mesh) size and sex selectivity to ensure conservation. There are vessel replacement rules for all fleet to control growth of capacity. Limits on the quantity/dimension of gear or the amount of time a unit of gear that can be used are usually required as a licence condition for most fixed gear fisheries. There are also restrictions on the dimension of gear in certain mobile gear fisheries such as Southern Gulf of St. Lawrence scallop, Pacific herring and salmon seine fisheries. Such limits are usually set uniformly for all vessels in a given fleet or fishery rather than varying by individual vessels.

In 1990, the Supreme Court of Canada issued a landmark ruling in the Sparrow decision. This decision found that the Musqueam First Nation has an Aboriginal right to fish for food, social and ceremonial purposes. The Supreme Court found that where an Aboriginal group has a right to fish for food, social and ceremonial purposes, it takes priority, after conservation, over other uses of the resource. The Supreme Court also indicated the importance of consulting with Aboriginal groups when their fishing rights might be affected. In response to this decision, and to provide stable fishery management, Fisheries and Oceans Canada (DFO) launched the Aboriginal Fisheries Strategy (AFS) in 1992. The AFS is applicable where DFO manages the fishery and where land claims settlements have not already put a fisheries management regime in place (DFO, 2008-2010).

In Table 5 the development of active fishing vessels by length group for the period 2004-2006 is presented. In total the Canadian fleet shrunk by 1%, but changes differ quite extensively between length categories.

Table 5: Number of active Canadian fishing vessels by length group, 2004-2006

	2004	2005	2006	Change 2004 - 2006
Unknown	11	139	205	
< 10 m	7,984	8,025	8,055	*1%*
10-14 m	7,125	6,996	6,871	*-4%*
14-20 m	1,437	1,417	1,256	*-13%*
20-30 m	260	242	228	*-12%*
>30 m	87	81	72	*-17%*
Total	*16,904*	*16,900*	*16,687*	*-1%*

Source: DFO, 2008

Following continuous decline in the landing of Atlantic ground fish (notably cod), leading to the collapse of the resource base, a moratorium was imposed on commercial fishing for Northern Cod in July 1992. The Pacific salmon industry continues to suffer from declining stocks and poor financial performance on the part of fishers and processors. The industry's problems remain linked to overcapacity. Efforts to conserve, protect and develop the fish resources and improve their utilization include strict limitations on places and times when fisheries are allowed (Pitcher *et al.*, 2002).

In response to the resource downturns in the Atlantic ground fish and Pacific salmon fisheries special restructuring and adjustment programs were established during the 1990s. These programs were delivered in the form of licence buyback and early retirement programs as well as short-term income support, retraining and economic diversification to assist affected fisheries workers and communities. In addition, over the years, DFO has been charging fishing industry for issuance of licences, permits and other privileges. The guiding principle is that those who benefit from access to a public resource managed at public expense should pay a fee that reflects the value of the access privilege. Rather than a pure 'rent' calculation, however, this is approximated by a charge on benchmark landed values or on individual quotas authorized (OECD, 2005b).

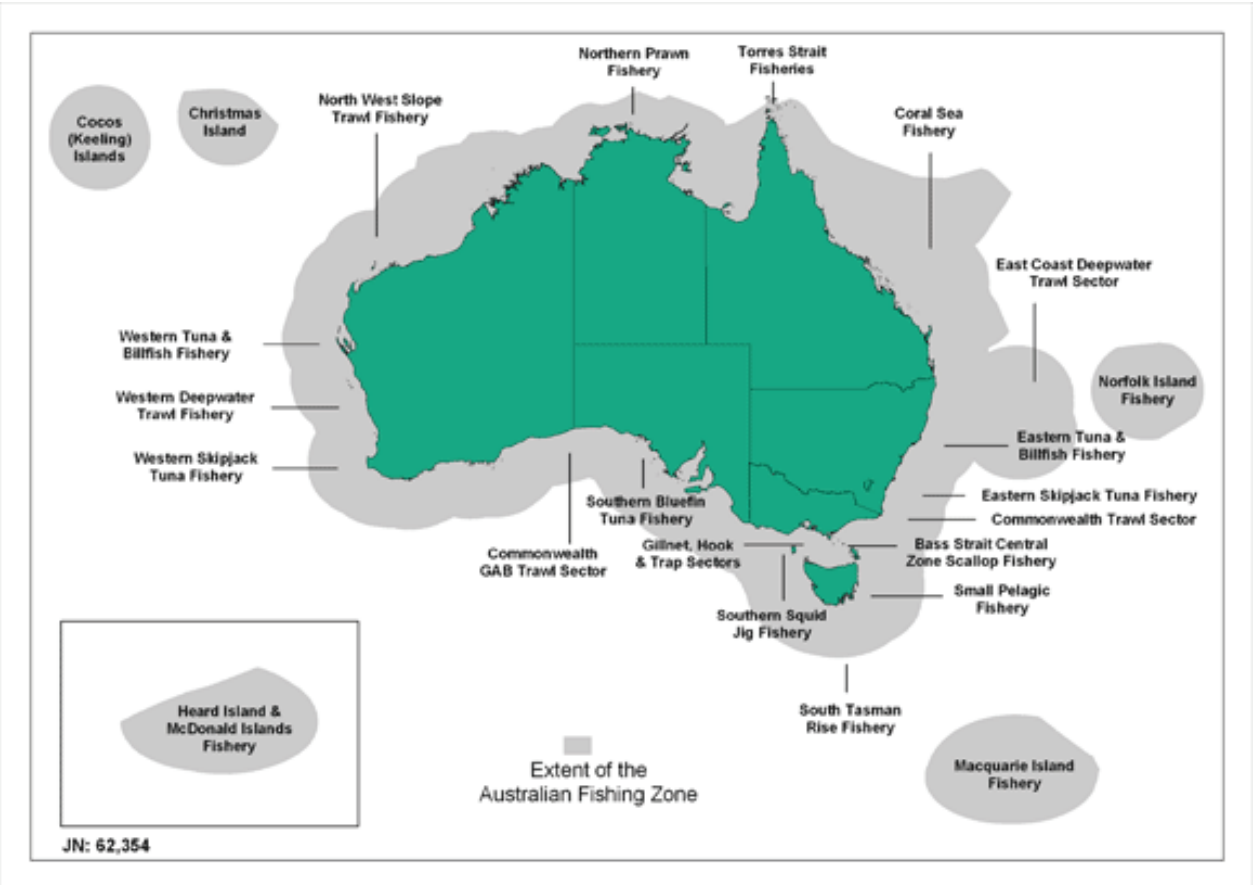
Market-like instruments, in the form of Enterprise Allocations (EA) and Individual Quotas (IQ), have been introduced in some fisheries as a way to integrate capacity and catch control to overcome the common property problem (OECD, 2005b). In the case of Canada's fisheries, or at least certainly Canada's Pacific fisheries, licence limitation/limited entry

schemes, combined with an Olympic style "total allowable catch" (TAC) harvesting (or equivalent thereof) were designed to prevent the build up of excess capacity in fisheries with TACs. Every participating vessel was required to have a licence. The number of licences was strictly limited. The TAC harvests were Olympic in style, in the sense that the limited number of licensed vessels competed with one another for shares of the global quotas. The fishers that were the fastest, most aggressive, and best equipped "won the race" (Munro *et al.*, 2009). Munro *et al* (2009) in evaluating the move to harvesting rights (ITQs) management schemes in three British Columbia fisheries, the B.C. Pacific Halibut fishery, the B.C. Sablefish fishery, and the B.C. Ground fish Trawl fishery respectively, conclude that improvement, both in terms of enhancing the economic viability of the fisheries, and in terms of ensuring the sustainability of the fishery resources providing the basis of the fisheries. Key to the improvement lies in transforming the interaction among the relevant fishers from competition to cooperation.

3.3. Australia

Australia's commercial fisheries are managed by the Commonwealth, the states/Northern Territory or through a joint authority comprising of the Commonwealth and one or more states/Northern Territory. A number of fisheries cross state, Territory, and Commonwealth jurisdictions. The Offshore Constitutional Settlement (OCS) arrangements provide practical management of these fisheries across jurisdictions. In the absence of an OCS arrangement, state/territory laws apply to coastal waters (up to 3 nautical miles) and Commonwealth laws apply from those waters out to the limit of the Australian fishing zone (200 nautical miles)(Department of Agriculture, 2009).

Figure 3: The Australian fishing zone



The Australian Fisheries Management Authority (AFMA) is the statutory authority responsible for the efficient management and sustainable use of Commonwealth fish resources on behalf of the Australian community. AFMA pursues a cooperative management approach to enable relevant stakeholders to take part in management processes alongside fisheries managers, but with management decision-making powers vested in the AFMA board. AFMA has set up management advisory committees (MACs) for each of the major Commonwealth fisheries.

Australian Government policy with respect to fishery management is based on the principle that fisheries are a community owned resource. While access rights to a fishery can be privately owned in Australia, marine resources remain the property of the community. Under the *Fisheries Management Act 1991*, AFMA may allocate four separate types of fishing concessions: statutory fishing rights; fishing permits; scientific permits; and foreign fishing licenses. For fleet management the most relevant are the statutory fishing rights and fishing permits.

Statutory fishing rights are defined as a right to a specified quantity or proportion of fish; a right to use a boat in a managed fishery; a right entitling a person to use specified type or quantity of fishing boats or equipment; or any other right in respect of a managed fishery. These rights include fish quota and boats and/or gear units. They are freely transferable, unless otherwise specified in the management plan. The term of the right, if not otherwise specified in the management plan, will continue until it is surrendered, cancelled or the plan revoked. By allowing the right to be permanent, the owner of the right has a planning horizon that is relatively secure which provides better incentives to make efficient investments in harvesting techniques and in developing new markets (OECD, 2005a).

Fishing permits are defined in a similar manner to statutory fishing rights, but are used where no plan of management for a fishery exists. Fishing permits allow access to specific fisheries and to specific areas of the Australian Fisheries Zone[4] subject to certain conditions (such as equipment that can be used or species that can be taken).

A range of output and input based management techniques are applied to Commonwealth fisheries in Australia (see Table 6). Input controls include time based controls, such as seasonal closures; location based controls, such as area closures; entry based controls, such as licensing; and gear based controls, such as net limits and boat size limitations. Output controls include total allowable catches and individual transferable quotas (ITQs). ITQs are currently applied to the southern blue fin tuna fishery and to 16 species in the south east fishery (OECD, 2005a). In most fisheries a combination of management mechanisms are applied involving limited entry, time and area based controls and either gear and/or output based mechanisms. For example, in the Northern Prawn Fishery operators need endorsements (licenses) to fish, are subject to seasonal closures and area limitations, and are required to hold a minimum number of units based on boat size and operating configuration.

Commonwealth fisheries are managed on a full cost recovery basis. This means that the commercial fishing industry pays for costs directly related to fishing activity while the Australian Government pays for activities that may benefit the broader community and satisfy a range of specific community service obligations (OECD, 2005a). State Governments have the responsibility of administering Australia's fisheries within three nautical miles from the

[4] The AFZ, which was first declared in 1979, is exactly the same area as the EEZ but relates only to the use or protection of fisheries, whereas the EEZ relates to all types of resources in the zone (e.g. fish, oil, gas, minerals, etc.). Also, under the EEZ regime, where the edge of the continental shelf of Australia extends beyond 200 nautical miles, Australia has the right to explore and exploit the non-living resources as well as sedentary fisheries species in this area (National Oceanic and Atmospheric Administration, 2008).

coast line. Most fisheries are managed using a variety of input controls although quota management systems are in place in a small number of fisheries. In *Western Australia* commercial fisheries are managed through a system of limited entry licensing which aims to prevent the over-harvesting of fish stocks through a range of input and/or output controls. Controls are set out in the management plan for each fishery. In recent years this approach has been extended to include not only the major commercial fisheries, but also the State's smaller, regional fisheries. Individual transferable quotas are applied to the abalone fishery, the Shark Bay snapper fishery and the pilchard fishery.

Queensland's fisheries resources are managed under a variety of input and output control measures, including limited entry, area and seasonal closures, size limits and, in some fisheries, quota management arrangements. *New South Wales* manages its commercial fisheries through a variety of input control measures together with limited entry to all the State's commercial fisheries. Quota management measures are currently in place for rock lobster and abalone. All fishing resources in *South Australia* are now managed by Fishery Management Committees, made up of representatives from major stakeholder groups, including commercial and recreational fishers, scientists and fisheries managers. Currently most fisheries are managed under a variety of input and output controls, with the Southern and Northern Zone Rock Lobster fisheries, abalone, blue crab, giant crab and pilchard fisheries subject to individual transferable quota regimes. In the *Northern Territory* commercial fisheries management is by limited entry, with a variety of input controls. The management of *Victorian* commercial fisheries is based on a system of licenses. Certain fisheries comprising abalone, rock lobster, giant crab and scallop are managed by quota allocations. In addition specific fisheries such as abalone and rock lobster are further regulated by management plans. *Tasmania*'s abalone and rock lobster fisheries are controlled mainly by individually transferable quota management, supplemented by size limits, gear restrictions and seasonal closures.

In Table 6 the profile of Australian fisheries and the relevant management arrangements is presented. In addition figures on the development of number of concessions, vessels and permits is presented. An attempt is undertaken to provide an indication of the development of Australia's fishing fleet by comparing the number of vessels or permits in 2008 with those of 2004. As can be expected in such a diverse situation, the figures show different developments between fleet segments. However, a main trend between 2004 and 2008 has been a decline in number of vessels or permits for the majority of fisheries.

Table 6: Profile of Australian fisheries and management arrangement

Fishery	Management	1999	2004	2008	*Change 2004-2008*
Northern Prawn	Limited entry, seasonal closures, permanent area closures, gear restrictions and operational controls)	109 concessions	96 vessels	52 vessels	*-46%*
Torres Strait	Limited entry, gear and effort controls, closed areas and seasons	493 concessions	414 rock lobster 271 mackerel 125 pearl shell 70 prawn 136 sea cucumber 95 trochus 117 crab 239 line 151 net	393 rock lobster 201 mackerel 99 pearl shell 53 prawn 73 sea cucumber 110 trochus 97 crab 239 line 180 net	*-5%* *-26%* *-21%* *-24%* *-46%* *+16%* *-17%* - *+19%*
South East Trawl	Limited entry, gear and area restrictions, ITQs, TACs	110 trawl, 119 non-trawl concessions	106 vessels	118 vessels	*+11%*
Gillnet, Hook and Trap Fishery	Limited entry, size limits, gear restrictions, closures, TACs and ITQs	NA	205 vessels	134 vessels	*-48%*
Great Australian Bight	Limited entry, gear and area restrictions and TACs (for shark only)	8 concessions	10 vessels	5 vessels	*-50%*
Southern Bluefin Tuna	Limited entry, ITQs and TACs, area restrictions	88 concessions	64 vessels	58 vessels	*-10%*
Eastern Tuna and Billfish	Limited entry, vessel size and area restrictions, bycatch provisions, gear restrictions and closures	270 concessions	298 permits	167 permits	*-44%*
Southern and Western Tuna and Billfish	Limited entry, gear and area restrictions, by catch provisions	7 western only, 72 southern and western, 45 southern	125 permits	97 permits	*-23%*

Fishery	Management	1999	2004	2008	*Change 2004-2008*
Bass Strait Scallop	Limited entry, closures, size limits and quotas	154 concessions (fishery closed 1999)	133 permits	152 boat SFRs[5]	
Small Pelagics	Limited entry and trigger TACs	NA	77 permits	73 permits	*-5%*
Southern Squid	Limited entry (gear-unit allocation and catch-triggers proposal)	56 concessions	80 permits	57 permits	*-29%*
Antarctic	Limited entry, TACs and ITQs, closures, bycatch restrictions	2 concessions	3 vessels	3 vessels	-
Western Deepwater Trawl and North West Slope	Limited entry	16 concessions	18 permits	18 permits	-
Coral Sea	Limited entry with a minimum operational commitment of 20 days per year. Catch limits for sea cucumber sector	NA	18 permits	19 permits	*+6%*
South Tasman Rise	Limited entry and TACs	NA	14 permits	14 permits	-

Source: Australian Bureau of Agricultural and Resource Economics, 2000, 2005, 2009

The major underlying problem in most Australian fisheries is perceived to be excess fishing capacity (OECD, 2005a). The majority of management arrangements are directed specifically at limiting fishing effort by one means or another. Initial efforts at fisheries management in Australia were in the form of limited entry arrangements. Such arrangements had little impact on fishing effort. Often fishers with only a limited history of involvement in a fishery gained access rights and so were able to increase effort in that fishery. Moreover, effective effort in a fishery could still be increased through technological improvements. As a consequence of these problems, in recent times more sophisticated input and output control mechanisms have been applied to most fisheries in Australia by the relevant fisheries managers.

In its 2003 review of Fisheries Management the Australian Government recognized the fact that fishing capacity in Commonwealth fisheries will have to be managed to facilitate the recovery of depleted fish stocks (Department of Agriculture, 2003). In this the emphasis will remain on using output controls in the form of individual transferable quotas as the preferred management approach to reward productivity improvements and enable adjustment to market pressures by operators. Importantly, ITQ-based management provides the

[5] Statutory Fishing Rights; under a Management Plan fully transferable Statutory Fishing Rights (SFRs) are granted that determine the number of vessels that may operate and the amount of gear used in the Fishery (National Oceanic and Atmospheric Administration, 2008).

framework of market-based adjustment as the fishery changes over time (OECD, 2005a). However, the Government also recognises there may be occasions where the nature of a fishery and of its broader ecosystem issues may mean that ITQs may not be the most appropriate management system. Under these circumstances, where the AFMA Board considers that a management system based on alternative management approaches, such as approaches based on individual transferable effort (ITE), will better pursue its legislative objectives, this form of management may be used.

In New South Wales, the government is currently in the process of issuing improved property rights in that State's fisheries (OECD, 2005a). The arrangements include allocation of shares to commercial fishers in accordance with current fishing rights and previous participation in various defined fisheries. As part of the scheme, fishers are required to pay a community contribution, representing a return to the community for privileged access to a public resource.

In 2006 a buyback programme intended to half the then existing Commonwealth fishing concessions (800 of a total of approximately 1600) was implemented. Three of the four fisheries that were stated to be primary targets of the buyback package were active in southeast region: the multi-part Southern and Eastern Scalefish and Shark Fishery (SESSF), the Eastern Tuna and Billfish Fishery, and the Bass Strait Central Zone Scallop Fishery. The objectives of the buyback were, in summary, to provide an opportunity for fishermen to exit an industry that was in a deteriorating economic position, to improve the economic position of those fishermen who chose to remain in the industry, to enhance the status of stock, and to adjust fishing effort in ways that accommodated for the loss of fishing grounds resulting from creation of MPAs (Minnegal and Dwyer, 2008).

In the buyback programme the Government would buy the ''right to fish'' from the fishers; ''right to fish'' was variously represented by a permit, or by a statutory fishing right to gear, boat or quota, and, for purposes of the buyback, all were referred to as ''fishing concessions''. There was no requirement that a person relinquishing a fishing concession would exit fishing. Further, although Government would not buy fishing boats, they offered AUD$ 25,000 to any fisherman who, at the time submitted an acceptable tender, contracted to scrap a boat that was nominated against a particular fishing concession and to do so in an ''environmentally responsible'' way (Minnegal and Dwyer, 2008).

Approximately 34 percent of 1600 Commonwealth fishing concessions were removed in the buyback (Minnegal and Dwyer, 2008). One aim of the buyback was to improve both the sustainability and the profitability of the fishing industry through a reduction in the number of fishermen targeting available fish. Certainly, the buyback did reduce the number of fishermen operating in Commonwealth waters, yet in at least some fisheries, Total Allowable Catches were less after the buyback than before the buyback. In the SESSF (trawl, scalefish hook, and shark fisheries) 27 species, further divided as 34 stocks, are subject to ITQ management. In late 2005, after announcement of the buyback, projected TACs were released for both 2006 and 2007. The 2007 TACs entailed reductions for 11 species (17 stocks). The average reduction across all species (stocks) was 20.3 percent (equivalent to a total of 6063.4 metric tons landed weight). In these fisheries the number of concession-holders was reduced by 39.9 percent through the period of the buyback. If all quota was held by concession-holders then, on average, the post-buyback increment in allowable catch (across all species) for each of the remaining concession-holders would have amounted to 13.3 percent of their original allowance. However, in fisheries subject to ITQ management, many quota-holders do not hold a fishing concession but, rather, lease quota to active fishermen. For example, in 2007 approximately 25 percent of 100 quota-holders in the shark fishery were not themselves active fishermen. It is doubtful, therefore,

whether the economic position of the average fisherman—as reflected in their access to fish—was substantially improved after the buyback.

3.4. New Zealand

New Zealand's commercial fisheries are unique in that they are managed under a comprehensive Quota Management System (Hammond, 2005). New Zealand was one of the first nations to introduce a management system based on ITQs. The New Zealand commercial fisheries can be divided in the pelagic, deep-water, mid-water and inshore fisheries. The New Zealand Quota management System (QMS) was introduced in 1986. However, in deepwater fisheries a preliminary ITQ approach had been in force since 1982.

When New Zealand introduced the EEZ in 1976, it suddenly became responsible for the fifth largest EEZ in the world, measuring 4,1 million km^2. At the time, the deep-water fishery was mainly conducted by foreign vessels. The new responsibility for this large sea area led to the awareness that the New Zealand Area should be managed properly if it is to be fully developed into a valuable national resource. The New Zealand government adopted a policy aiming at expanding the national fisheries.

Figure 4: New Zealand fisheries management areas

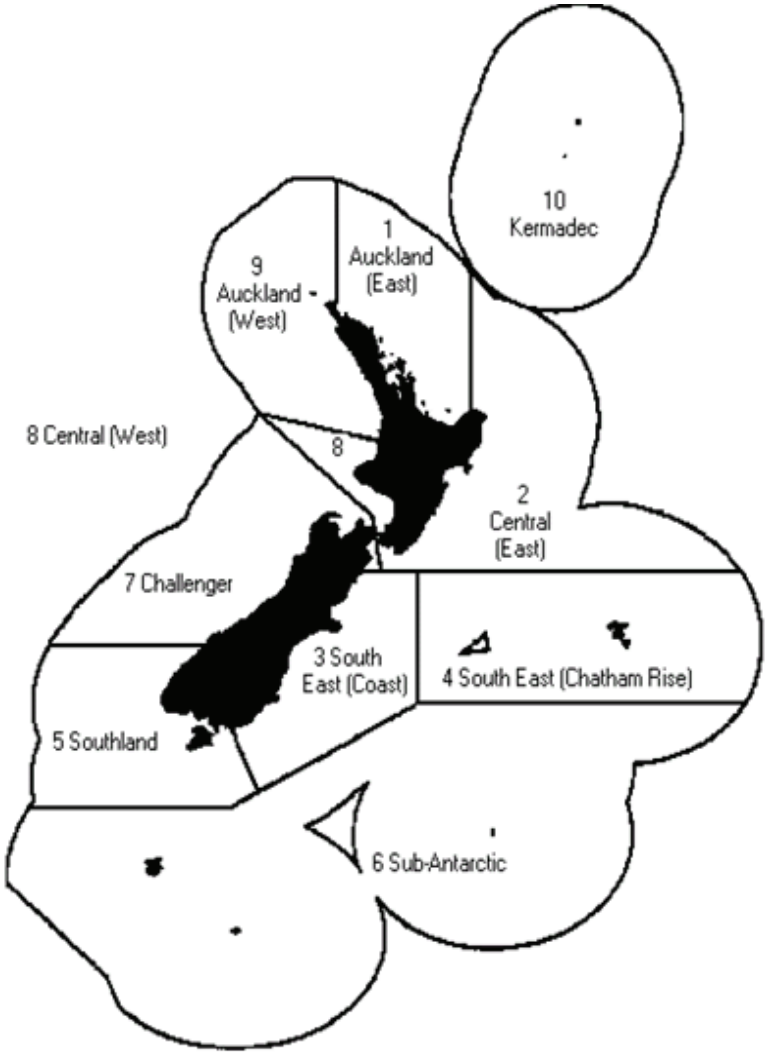
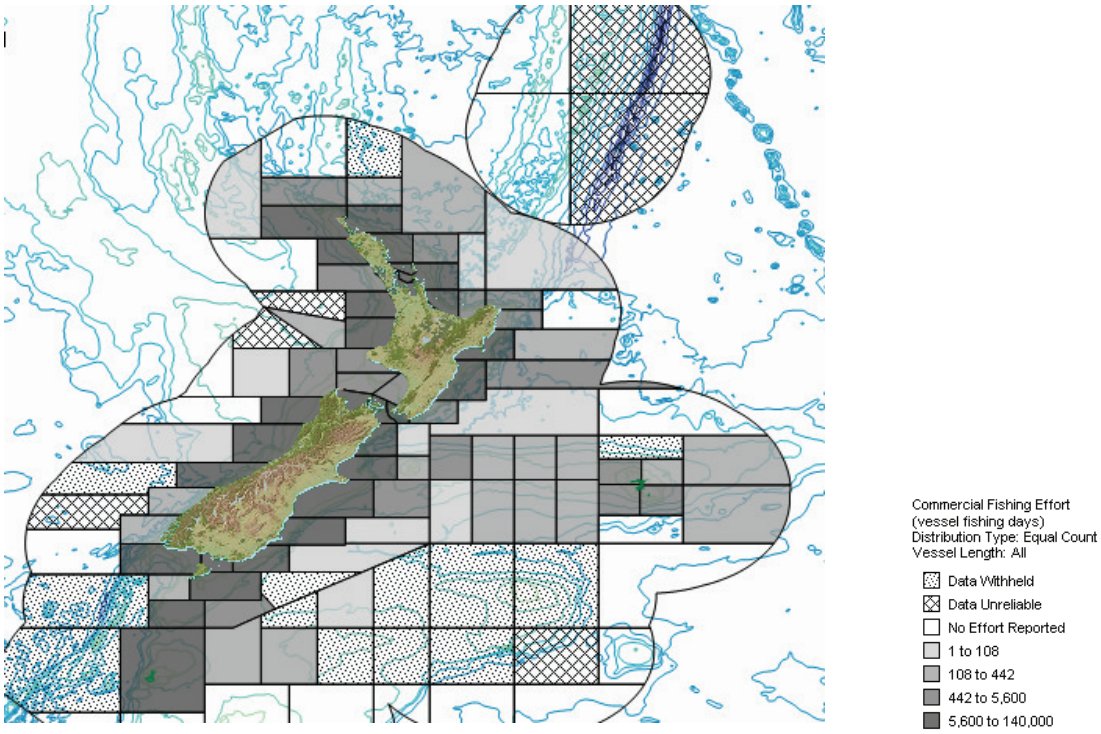


Figure 5: New Zealand Commercial fishing effort 2007



This policy led to substantial investments in new vessels. However, profitability of the deep-water fishery remained marginal. In 1982 the New Zealand authorities introduced transferable company quotas in order to facilitate restructuring and rationalisation of domestic fisheries. Nine companies were allocated quotas within the seven commercially most interesting species on basis of a combination of catch history and commitment in terms of investment in the off shore fleet and/or onshore processing. A small amount of quota was reserved for a number of smaller participants. The quotas were allocated provisionally on a ten years basis, to be partly transferable within companies with at least 75% national ownership. The quota had to be paid for by an annual "resource fee" in order to prevent privatisation of "Crown resources". Tradability was free on condition that no single company could obtain more than 35% of the total quota. In 1986 it was clear that the quota system had been a success. In the period 1982-1986, total catches in the deep-water fishery increased by 83% with an increasing share of domestic catches and a decreasing share of foreign licensed nations. Employment in the New Zealand fishing sector increased from 7,800 to 9,800 people.

The quota system in deep-water fisheries was set up purely for economic reasons. Its success however, has undoubtedly played a role in the choice for an ITQ system as a tool to solve the crisis in inshore fisheries. During the 50s, 60s and 70s the fisheries management was largely based on input measures, mainly licensing. There was no restriction on the number of permits available. In the mid-seventies the inshore fisheries declined dramatically due to increased pressure, caused partly by the government support to develop the fisheries sector during the sixties and seventies and partly by the successful introduction of snapper, hapuka and other commercially important species on the export markets. In 1982 a general moratorium on new fishing licenses was imposed in order to limit the overcapitalisation of the inshore fleet. In 1984 an ITQ regime was proposed by the Ministry as a response to the crisis in inshore fisheries and after extensive consultation with the industry during 1984 and 1985, the Quota Management System was introduced in 1986, integrating the management of inshore and deep water fisheries. Main objectives for introduction of

the Quota Management System were, according to the public consultation document of Ministry of Agriculture and Fisheries (MAF):

- to achieve the long term continuing maximum economic benefits from the resources;
- to preserve a satisfactory recreational fishery.

Direct aims of the policy were:

- to rebuild fish stocks to their former levels;
- to ensure that catches are limited to levels that can be sustained over the long run;
- to ensure that these catches are harvested efficiently with the maximum benefit to fishermen and the nation;
- to allocate each entitlement equitably based on fishermen's current commitment to the industry;
- to manage the fisheries so that fishermen retain maximum security of access to fish and flexibility of harvesting;
- to integrate the ITQ system of the inshore and deep water fisheries;
- to develop a management framework that can be administered regionally in each fisheries management area;
- to financially assist the harvesting sector to restructure its operations to achieve the above aims;
- to enhance the recreational fishery.

In order to implement the QMS system, the New Zealand EEZ was carved up into ten Fisheries Management Areas (FMA). ITQs were specified as the individual perpetual right to a part of the fish harvest designated in metric tonnes (not as a share of the TAC) for a particular species group to be taken from a specified quota management area (QMA). Each QMA comprised one or more Fisheries Management Areas, based on biological stock distributions. So each species was split into one to ten quota stocks nationally. The combination of 27 quota species and ten QMAs resulted in 179 management units, representing 83% by weight of the total finfish catches in the commercial fishery in 1985. Subsequently TACs were fixed by MAF biologists for each stock and sub-stock.

Immediately after the decision of the Cabinet to implement the QMS, the indigenous people of New Zealand, the Maori, challenged the legitimacy of the system on the basis that the government principally could not create exclusive rights of access to fishery resources. According to the Treaty of Waitangi (1840) and the fisheries act 1983, the Maori claimed that the fishery resources were not Crown property but they were owned by the Maori being the original inhabitants of New Zealand. This prevented further development of the QMS until the Maori fishing rights were settled in 1992 (Settlement Act 1992). The Maori claimed part of the existing quota for their commercial fishery and a priority right for their customary fishing. The Maori commercial fishing rights were finally settled in the Settlement Act 1992, which promised the Maori commercial fisheries 20% of the TAC for all new species brought into the QMS. The Act also established Maori customary fishing as a separate sphere of the fishing sector, with a priority right over and above any commercial and recreational allocation. The Act promised development of regulations for Maori customary fishing. The customary fishery is managed separately from the commercial fisheries by local guardians, appointed by the Maori tribes. They are obliged to deliver information about catches to the central government to facilitate resource assessments (van Hoof *et al.*, 2002).

The Fisheries Act 1996 brings about several significant changes. An "ecosystem approach" (recognising the interconnections of species and habitats) is adopted to ensure the sustainability of the environment as well as fish stocks. Secondly, New Zealand is moving to an approach where fisheries management will be conducted in a planning framework that provides for stakeholder-led management. Specific management plans will be developed for

each fishery. A greater role is earmarked for the Seafood Industry Council (Seafic), which subsumes the functions of the NZ Fishing Industry Board (FIB) and NZ Fishing Industry Association (FIA) as an adviser to the Minister, who under the new Act has increased powers. Twenty-seven quota owning groups or companies are set up to interact with the Ministry and represent the interests of their quota holders (Ministry of Fisheries, 2009).

Today the preferred means of managing fisheries is using the Quota Management System (QMS). Since the QMS was introduced in 1986 with an initial 29 species or species groups, its coverage has steadily grown and it is now used to manage 95 species or species groups (a further 15 species or species groups are being considered for QMS management). The QMS now manages over 90% of the commercial fishery harvest.

Each stock has a Total Allowable Catch (TAC). The Minister of Fisheries sets the TAC with reference to the maximum sustainable yield (MSY) (OECD, 2005d) for each Quota Management Areas. In fisheries where non-commercial users are involved (e.g. customary Maori or recreational fishers), a quantity of stock is set aside for them before the commercial catch (TACC) is set. The TACC is set in volume (e.g. tonnes) allowed to be caught each year and can vary from year to year. It is divided into a number of Individual Transferable Quotas (ITQs), which are effectively rights to fish a defined portion of the TACC (The New Zealand Seafood Industry Council, 2010). Each quota share generates an Annual Catch Entitlement (ACE) at the beginning of each fishing year. ACE therefore represents the amount of a particular species a fisher can physically catch in a particular fishing year. Both ACE and quota shares are freely tradable (OECD, 2005d).

For all QMS stocks, the commercial fisher must balance the catch with ACE or pay a "deemed value" for the fish. A deemed value is an administrative fee set at a level designed to encourage fishers to acquire ACE to cover their catch. A commercial fisher will be liable for deemed values for any catch in excess of ACE held on a monthly basis. A deemed value demand may be satisfied by acquiring ACE or by paying the amount demanded. If a person does not take one of these courses of action, his or her commercial fishing permit can be suspended. Permits are not transferable and to go fishing without one is a serious criminal offence. This catch-balancing regime is administrative in nature, but set within a criminal offence regime.

New Zealand's fishing fleet has reduced in size and become more efficient as a result of the Quota Management System. The quota system has eliminated an issue New Zealand faced in the 1970s of there being too many boats chasing too few fish. Back then, government subsidies and high export prices attracted more and more fishers with better boats and gear. Along with some ineffective management, this led to species like snapper, scallop and rock lobster being over-fished. (Ministry of Fisheries, 2009).

In table 7 some data on the development of the New Zealand fishing fleet are presented. Overall the fleet diminished in seize by some 26%; however this was mainly realised in the under 15 meters vessel category.

Table 7: New Zealand fishing fleet development 1984-1995

Vessel length	*1984*	*1987*	*1992*	*1995*
15 m	2,123	1,326	1,211	1,444
15-30 m	242	175	257	272
30+ m	10	13	30	50
Total	*2,375*	*1,553*	*1,498*	*1,766*

Source: van Hoof *et al.*, 2002

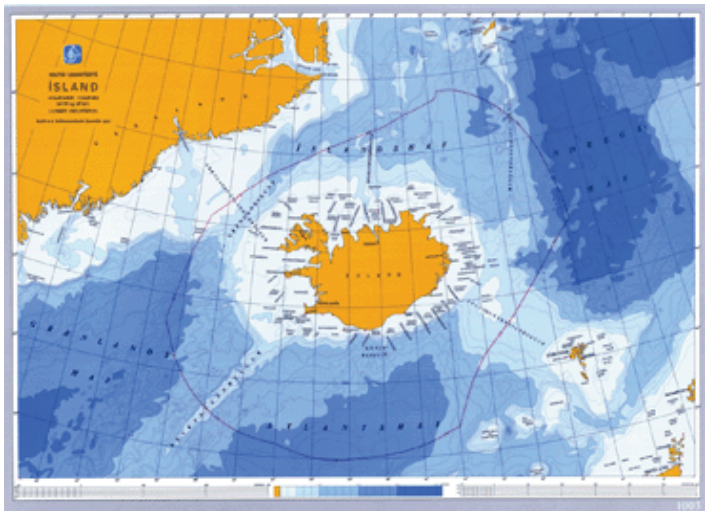
The number of registered commercial vessels has up to 2005 continued to decrease at a rate of some 100 units per year (FAO, 2005-2010). In 2001, it was estimated that there were 1,400 New Zealand fishing vessels and 230 foreign vessels operating in the New Zealand marine environment (Statistics New Zealand, 2003). Compared to 1995 this would mean an additional decrease of the fleet with some 21%.

3.5. Iceland

Like in New Zealand the main instrument in fisheries and fleet management is a system based on Individual Tradable Quota (ITQs). During the past 15 years there has been no specific fleet management system in Iceland. Fishing licences are readily available for anyone with a seaworthy vessel. No decommissioning schemes are in place - all decommissioning has happened due to the ITQ system pushing companies to buy out vessels to increase their share of the TAC by buying the quota attached to vessels. Some inshore fishery has existed inside the ITQ system and also outside of it as controlled artisan fishery based on number of fishing days/boat. In 2009 this inshore scheme was expanded by the government leading to protest by the existing actors in the ITQ system for larger vessels as this is seen to encroach on their rights as the TAC is the limiting factor.

For most of their early history the Icelandic fisheries were based on the harvesting of demersal species, especially cod and haddock. The herring fishery was not initiated until the last decades of the 19th century. During the last 100 years the variety of species being exploited has greatly increased (OECD, 1997). Since the beginning of the 20th Century, the Icelandic fisheries have expanded rapidly. The herring fishery expanded and became significant in the 1920s and 30s. Saithe became an important commercial species in the 1920s, redfish in the 1940s, shrimp and nephrops in the 1960s, capelin and scallops in the 1970s, Greenland halibut in the 1980s and, most recently, blue whiting in the late 1990s. This diversification in species has been accompanied by increasing catch volumes (OECD, 2005c).

Figure 6: Iceland fisheries zone



The extension of the Icelandic EEZ to 50 nautical miles in 1972 and to 200 miles in 1976 created the necessary basis for fisheries management (van Hoof *et al.*, 2002). The extension meant that many, albeit not all, of the most important fish stocks off Iceland came under exclusive Icelandic control. As a result, it became possible for the Icelandic fisheries authorities to introduce new fisheries management regimes. Since then a variety of fisheries management systems have been tried in Iceland including (a) total catch quotas, (b)

fishery access licenses, (c) fishing effort restrictions, (d) investment controls and vessel buyback programs and (e) individual vessel catch quotas (OECD, 2005c). In Table 8 a historic overview of management practices in Icelandic fisheries is provided.

Table 8: Overview of history of Icelandic fisheries management measures

Pre 1965	Little fisheries management. Fishing gear and area restrictions in some fisheries
1965-75	Inshore shrimp and scallops fisheries. Mixture of access limitations, effort restrictions and, in the scallops fisheries, processing plant quotas.
1969	The herring fishery: Total quota.
1972	The herring fishery: A harvesting moratorium.
1976	The herring fishery: Individual vessel quotas.
1976	The demersal fisheries: Total cod quota.
1977	The demersal fisheries: Individual effort restrictions.
1979	The herring fishery: Vessel quotas made transferable.
1980	The capelin fishery: Individual vessel quotas.
1984	The demersal fisheries: Individual transferable vessel quotas. Small vessels exempted.
1985	The demersal fisheries: Effort quota option introduced.
1986	The capelin fishery: Vessel quotas made transferable.
1988	A system of transferable vessel quotas in all fisheries. Effort quota option retained in demersal fisheries.
1991	A fairly complete uniform ITQ system in all fisheries. Small boats exemption retained.
Post 1991	Various measures to control the expansion of the small vessels fleet. Modifications of the ITQ system.

Source: OECD, 2005c

Individual vessel quotas were first introduced in the fishing for pelagic species, herring and capelin. When the fishing from the herring stocks in Icelandic waters was resumed in 1975, after three years of moratorium, the fishing was managed with individual vessel quotas. The annual quotas were made transferable (tradable) in 1979. Individual vessel quotas were introduced into the capelin fishery in 1980 and the annual quotas were made transferable in 1986. Since 1991 the ITQ-system has covered more than 90% of all fishing in Iceland (van Hoof *et al.*, 2002).

The current individual quota fisheries management system is based on Individual Transferable Quotas (OECD, 2005c); stipulated in the Fisheries Management Act of 1990, catch limitation is based on the catch share allocated to individual vessels. Each vessel is allocated a certain share of the Total Allowable Catch (TAC) of the relevant species. The catch limit of each vessel during the fishing year is thus determined on basis of the TAC of the relevant species and the vessel's share in the total catch. According to Icelandic law the TAC is set by the Minister of Fisheries and Agriculture based on scientific advice from the Icelandic Marine Research Institute.

In addition to the ITQ system, Icelandic fisheries management includes many other management measures such as area restrictions, fishing gear restrictions, and the use of closed areas to conserve important vulnerable habitats. Extensive provisions are made for temporary closures of fishing areas to protect spawning fish from all fishing. These measures are all meant to support and secure the sustainability of the fisheries (Icelandic Ministry of Fisheries and Agriculture, 2010).

Individual Fishing Enterprises may not control more than the equivalent of 12% of the total quotas allocated for all species, and 12 - 35% for the various species, in terms of cod equivalent[6]. All commercial fishing of stocks that are subject to management is subject to these quotas.

In addition to the ITQ system, which together with the TAC imposition is the cornerstone of Iceland's fisheries management, there are a number of other measures designed to improve the sustainable yield of the stocks. There are rules concerning the type of fishing gear permitted, e.g. the minimum and maximum mesh size. Fishing with bottom trawl is generally prohibited 6-12 miles from the coast and in other areas, which serve as spawning and nursery areas. Sorting grids in fishing gear are obligatory in certain fisheries to prevent catches of juvenile fish. Extensive provisions are made for temporary closure of fishing areas to protect spawning fish from all fishing. Further to this, the Marine Research Institute has the authority, which it uses extensively, to temporarily close fishing areas if the proportion of immature fish in the catch is deemed to exceed acceptable limits.

In table 9 we see the development of the Icelandic fishing fleet over the period 1999-2008. We can note that the fleet has decreased over that period by some 23% in number of vessels, 12% in total gross tonnage and some 7% in total engine capacity. In interpreting the size of the Icelandic fishing fleet, according to the OECD, it is important to realize that not all registered fishing vessels participate in the Icelandic fisheries. Some simply lie idle. Some do not have a fishing license in Icelandic waters but are applied on distant fishing grounds or, in the case of the undecked vessels, used as recreational vessels. Overall, for 2002 OECD estimates that only about 77% of the registered fishing vessels in Iceland were applied to commercial fishing (OECD, 2005c).

Table 9: Icelandic fishing fleet development 1999-2008

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of ships	1976	1993	2012	1935	1872	1824	1752	1692	1642	1529
Gross tonnage (GT)	180890	180150	191437	191587	183725	191222	181530	179409	169279	159627
Power of main engine, kW	509650	522876	549193	543050	532627	539375	520242	516773	502289	471199

Source: Statistics Iceland, 2010

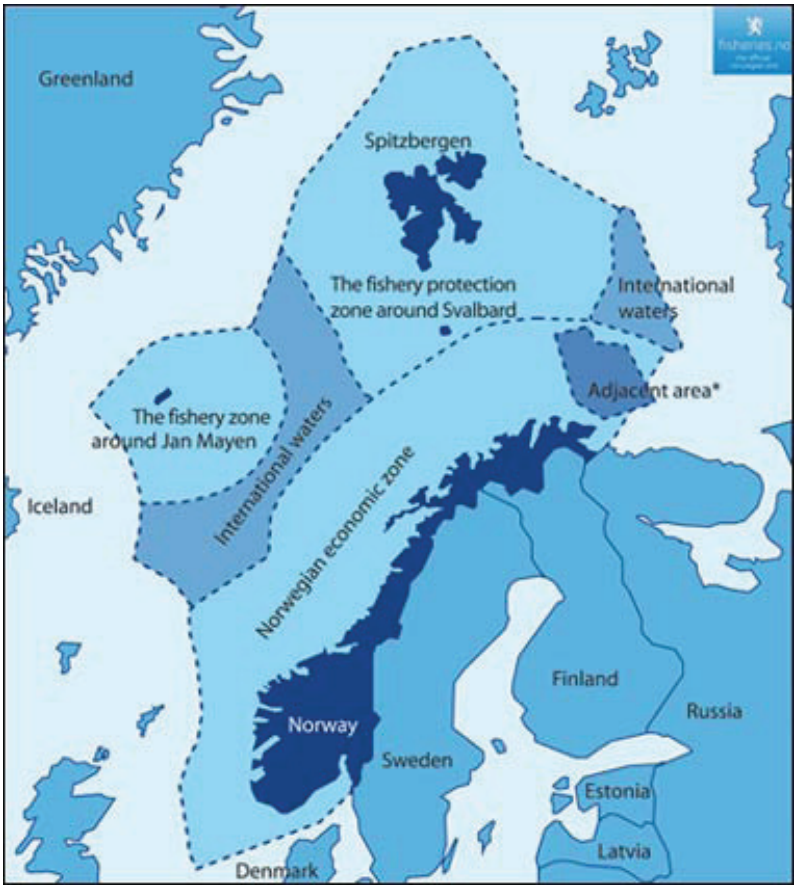
3.6. Norway

Going back in history, Norwegian fishery was initially a coastal fishery. To a great extent, fishery was combined with small-scale farming. Vessels were small, activity was based on the seasonal migration of fish, e.g. to the Lofoten area in January to April, and the activity was limited to grounds near the coast. Since 1900, great structural changes have taken place. Vessels have increased in size, have been changed from open to sheltered boats and the area of operation has expanded from coastal areas to the high seas. Fishing gears have increased very much in efficiency, changing from passive to active types of gear. Moreover

[6] As the Icelandic demersal fisheries are a mixed-stock fishery and vessels are bound to catch other species, the ITQs (or TAC shares) also are denominated in cod-equivalent terms, i.e., because cod is the most important species in the Icelandic fisheries, it is used as the common denominator for the whole ITQ system. For example in Cod equivalent values in 1995/96 are: Cod 1.00, haddock 1.10, saithe 0.55, redfish 0.8, plaice 1.30, Greenland halibut 1.70, capelin 0.05, herring 0.08, lobster (tails) 8.40, shrimp 1.00 and scallops 0.40 (Runolfsson and Arnason, 1997).

efficiency has improved very much particularly in the last part of the last century. To complete the picture, it must be added that during these changes, elements of the "old" fishing industry have been kept alive. Thus, besides a modern highly efficient fleet and modern processing plants, small-scale fisheries and small processing plants with very simple technology still exist (OECD, 2005e).

Figure 7: Norwegian fisheries management area



It can generally be said that fishers throughout history have been a strong political force in Norway. In earlier times, the small-scale fishing industry meant that the large number of fishers in itself was a dominating group in several counties. More recently, the organisation of fishers since 1926 has become an important political factor. The opposition from the fishery industry was a decisive factor behind Norway's negation of joining the European Community in 1972. Fisheries are also one of the main issues in the discussion on a possible membership in the European Union today (OECD, 2005e).

From ancient times regulatory measures have been used in Norwegian fisheries. During most of the time these measures had a local and distributive character, e.g. reserving certain areas for specific gear. It is only in the last century that regulatory measures have been based on biological considerations. The first nationwide regulations were mainly restricted to regulations on ownership of fishing vessels and of licences to fish. Only at a later stage were regulations used explicitly to reduce fishing activity.

The Ministry of Fisheries and Coastal Affairs together with subordinated agencies and institutions represent the most important fisheries management bodies in Norway. Norwegian fisheries have evolved into a highly regulated industry with quotas and licensing requirements. The most important fish stocks migrate between Norwegian and foreign waters and, consequently, good governance requires close cooperation with neighbouring countries. This means that the most critical management decision (the amount of fish that can be

harvested from a given stock), is an internationally determined premise for a domestic decision-making process. Consequently, international cooperation is a critical aspect of the Norwegian management regime. For the most important fish stocks quota levels are set in cooperation with other countries, including Russia, Iceland, the Faroe Islands and Greenland and EU Member States.

A primary basis for determining fishing quotas is the advices and recommendation from the International Council for the Exploration of the Sea (ICES). After ICES has given its quota recommendations, the negotiations on management issues between Norway and other states take place. After international negotiations are finalised, the domestic regulation process for quota allocation begins. The Directorate of Fisheries makes proposals for domestic regulation. The involvement of stakeholders in management decisions is achieved through the Advisory Meeting for Fisheries Regulations (The Regulatory Board) representing fishermen's associations, the fishing industries, trade unions, the Sami Parliament, local authorities, environmental organizations and other stakeholders. As a final step in this process, the Ministry of Fisheries and Coastal Affairs decides how the quotas should be shared between the vessels and sets out the technical regulations for how the fishing should be carried out in the following year.

Hence the output regulations in Norwegian fisheries management entail setting species TACs resulting in a national species quota for the Norwegian fishing fleet. The Norwegian TACs are split into group quotas, which correspond to the different groups of vessels. Individual Vessel Quota (IVQ) are fixed for each participating vessel holding a license or annual permit, which guarantees them a fixed proportion of the group quota. IVQs mainly apply to vessels with permits or licenses. Maximum Quota are allocated to coastal vessels in open access fisheries, also called Olympic quota. Once the group quota has been reached, fishing is stopped, regardless of whether each vessel has reached its Maximum Quota. This system is used in groups where the efficiency of vessels varies widely and includes many small vessels. Groundfish quota mainly regulate coastal vessels using conventional gear, rather than trawlers. Quota combining the quotas from cod, haddock and saithe from each vessel participating (FAO, 2005).

In addition, fisheries management instruments used in Norway are limitation of access through licensing, and technical regulations such as a discard ban and closed areas. For the management of fishing capacity several instruments are adopted; input regulations (to limit the fishing effort), structure regulations (to limit fishing capacity in a number of vessel groups) and output regulations (to limit the allowable catch; Olivert-Amado, 2008).

Concerning input regulations, licenses and permits are used. In general, the registration of fishing vessels in the "Register of Norwegian Fishing Vessels", as well as the acquisition of an already registered fishing vessel, requires a permit from the authorities (OECD, 2005e). Coastal fishing vessels, defined as vessels operating with traditional gear (e.g. net, longline, hand line, Danish seine) are in general not subjected to licensing, although their access to fisheries are regulated trough annual permits (OECD, 2005e). Although there is still open access to Norwegian fisheries for small fishing vessels using passive gear, in practice an increasing number of fisheries are regulated with access limited to vessels, or vessels owners, with historical track records. Licenses represent a right to participate in a fishery. They are attached to a vessel and an owner and may only be sold with a vessel or transferred to a new vessel under the current owner after an application to the fishing authorities.

Next to input regulations there are a number of structure policies which aim at reducing the fishing capacity in a number of vessel groups using instrument such as closed access on

stock basis, unit quota system, quota exchange system and decommissioning schemes (OECD, 2005e; Olivert-Amado, 2008).

The development of the Norwegian fisheries, from open access when everyone who fulfilled the requirements of being a fisherman would get a permit to fish with his boat, into limited access in addition to different vessel quota systems, has naturally lead to a notion of rights within the fishing community. Although, in principle the Norwegian fisheries are open, *closed access on stock basis* is implemented to such an extent that there are small possibilities of being a professional fisherman living only on unregulated stocks, as some 90% of the catch value comes from access-regulated fisheries.

The *Unit Quota System* (UQS)is a quota transfer system for many vessel groups, with the main purpose of reducing the number of vessels which then increases the income of each vessel. The system allows the owner of two vessels to fish both quotas from one vessel if the other vessel is withdrawn from fishing. If the vessel withdrawn from the fishing fleet is sold, the vessel owner may fish both quotas for a period of 13 years and for 18 years if the vessel is scrapped. So far the Unit Quota System has been implemented for the offshore fishing fleet for vessels above 28 metres fishing with traditional gear (long-liners). The Norwegian Parliament has as of June 2003 agreed to establish similar arrangements for the coastal fishing fleet. The UQS designed for the coastal fleet will enable vessels between 15-21 metres and between 21-28 metres to transfer a quota from one vessel to another if one vessel is scrapped.

The *Quota Exchange System* is envisaged for vessels less than 28 metres allowing two vessel owners to team-up both quotas on one vessel for three out of five years. The purpose of this arrangement is to improve vessel profitability and in the long run enhance incentives to reduce fleet capacity.

In table 10 the development of registered fishing vessels for the 1997-2007 is presented. Over the period the Norwegian fleet diminished by 48%. In 2008 a total of 6,790 were registered in the Norwegian fisheries (Norwegian Ministry of Fisheries and Coastal Affairs, 2009). This means that in the 2000s on average the fleet shrinks 8% per annum.

Table 10: Norway registered fishing vessels 1997-2007

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Total number of vessels	13,635	13,248	13,196	13,017	11,922	10,640	9,914	8,188	7,722	7,305	7,039

Source: Statistics Norway, 2010

Development has moved in the direction of fewer and more efficient fishing boats. Sustainable resource management is fundamental to the Norwegian fishing policy. Simultaneously, fisheries and fishing will help to safeguard settlements and create new activity along the coast (Norwegian Ministry of Fisheries and Coastal Affairs, 2009).

Norway uses decommissioning schemes as an instrument to reduce the fishing fleet. According to Hannesson (2004) buy-back programs have been in force since 1979. Grants have been given to scrap fishing vessels or to sell them out of the country. These programs have been targeted at different types of vessels in different periods. They have involved grants both for scrapping fishing vessels and for selling them for other uses, including to other countries. The purpose has, at least partly, been to improve the profitability of the vessels that remain. This has been accomplished by stripping the scrapped or transferred vessels of their fishing concessions; i.e., their rights to participate in specific fisheries such

as e.g. purse seining for capelin and trawling for cod or shrimp. With these concessions there usually goes a right to a certain portion of the total quota for one or more fish stocks and so, by nullifying the concession, the quotas of the remaining vessels and their profitability can be raised.

Approximately 3,500 vessels have been removed through decommissioning grants. Previously, the focus of this scheme was modernisation, but now the aim is reduction of the fleet capacity. Grants for constructing new vessels are no longer given. A new fund for decommissioning of vessels up to 15 meters, whose activity comply with a certain minimum level, was to be put in place. The scheme will reach funding through a tax on the value of first-hand landings and through public sector funds.

In Table 11 below the total budget allocations for Norwegian buybacks 1998-2002 is presented as well as the number of accepted applications.

Table 11: Total budget allocations for Norwegian buybacks 1998-2002 and number of accepted applications

Year	Budget in Million Norwegian kroner	Number of Applications accepted
1998	25.0	42
1999	35.5	68
2000	53.3	48
2001	21.0	36
2002	21.7	24
Total	165.5	218

Source: Hannesson, 2004

Market-like instruments as described above as "The unit quota system" have been introduced with the general idea to reduce the number of vessels in a certain vessel group where fishing capacity is considered to exceed current and future TACs. The unit quota system was introduced to the Cod trawlers in 1984. Since the introduction, the scheme has been adjusted several times. The present scheme for cod trawlers has been in place since 2000. Each vessel group have custom made schemes. The Greenland shrimp trawler fleet got their first unit quota system in 1994, purse seiners in 1996, vessels more than 28 meters fishing with traditional gear in 2000, saithe trawlers in 2001 and industrial trawlers in 2002. From 2004 fleet segments covering the largest costal vessels will also have access to unit quota arrangements, namely vessel groups 15 – 21 meters and 21 – 28 meters (OECD, 2005e).

Since 2000 there have been no new grants for building vessels or importing second hand vessels. There is however still financial support granted to fishermen who withdraw their vessels permanently from fishing activity and to those who withdraw their vessels and transfer their licence or fishing rights to a more efficient vessel and maintain fishing activity (FAO, 2005).

4. EU FLEET CAPACITY MANAGEMENT

Fisheries management under the CFP entails a mix of approaches and instruments, including input controls (e.g. gear restrictions) and output controls (e.g. quotas). Stocks in the North East Atlantic in particular have primarily been managed on the basis of Total Allowable Catches (TACs). In recognition of the fact that TACs have been insufficient to conserve fish stocks, they are being increasingly complemented by effort restrictions. Managing fishing capacity is thus one of several strands of the CFP management system(s). A key difference between capacity management and many other instruments is that Member States are legally obliged to put in place measures to adjust their fishing capacity to strike a balance with fish stocks, and a whole set of rules has been elaborated for Member States to work within (Brown, 2006).

The MS of the European Community have signed up to the international voluntary commitment to develop plans of action for capacity reduction under the International Plan of Action (IPOA) for the Management of Fishing Capacity. The IPOA has been elaborated within the framework of the Code of Conduct for Responsible Fisheries as envisaged by Article 2 (d) and the provisions of Article 3. The original objective of the IPOA was for States and regional fisheries organisations to achieve efficient, equitable and transparent management of fishing capacity worldwide. Inter alia, States and regional fisheries organisations confronted with an overcapacity problem, where capacity is undermining achievement of long-term sustainability outcomes, should endeavour initially to limit at present level and progressively reduce the fishing capacity applied to affected fisheries.

Since 1983 the European Union has deployed structural adjustment measures under the Multi-annual Guidance Programme (MAGP). These programmes aimed to restructure the Member States' fishing fleets by setting out a series of multi-annual capacity targets for all EU member states and their fleets. In order to remove excess capacity from fisheries, vessel decommissioning and effort reduction were the most frequent measures applied.

While the third set of MAGPs (1992-97) was relatively successful in reducing fleet capacity, the objectives fixed under MAGP IV proved to be too modest to help achieve a better balance on a sustainable basis between fisheries resources and the fishing activities of the EU fleet. As the efficiency of fishing vessels increased every year due to technological progress, MAGPs were not effective enough to achieve a significant reduction of fishing capacity. Attempts to tackle the overcapacity problem were also often undermined by the public aid that was granted for the modernisation or renewal of the fleet. Subsidies for construction and modernisation of fishing vessels, allocated under EU and Member States' aid schemes, may have aggravated the situation as they have not been accompanied by a sufficient decrease in capacity (European Commission, 2005).

Although most of the capacity reduction objectives of the MAGP were ultimately met, the translated effect of a similar reduction in fishing pressure on stocks did not materialise. In recent years the Common Fisheries Policy (CFP), the EU's fisheries management framework, has undergone a number of changes. The most significant of these was the '2002 reform' in which the Council agreed several legislative changes to the conservation and structural policies at the end of December 2002. The fleet management and subsidy system are significant areas of the CFP that have been changed as part of the reform process. Fleet capacity targets, set by fleet segment, were replaced with a rules-based fleet management system, embodied within the 2002 basic Regulation. The 2007-2013 European Fisheries Fund (EFF) was agreed in June 2006, replacing the 2000-2006 Financial Instrument for Fisheries Guidance (FIFG). The FIFG was, and EFF will be, the main instrument under which subsidies are provided, with the most direct capacity enhancing form now phased out.

These changes responded to the Commission's proposed EU Sustainable Development Strategy of May 2001, which included an objective to 'remove counter-productive subsidies which encourage over-fishing, and reduce the size and activity of EU fishing fleets to a level compatible with worldwide sustainability, while addressing the consequent social problems' (Commission of the European Communities, 2001; Brown, 2006).

The 2002 CFP reforms led to a shift away from setting national fleet segment target sizes centrally at the EU level, to establishing a rule based system and placing greater responsibility for fleet management with the Member States. The system is now based on a cap on national fleet sizes and vessel entry/exit rules (Brown, 2006). National reference levels were set on the basis of targets under MAGP IV and defined in terms of total GT and kW. When capacity is removed with public aid, the reference level is reduced accordingly. Aid for new-builds was phased out as part of the 2002 reform, being prohibited from 2004. Member States that chose to provide aid for new-builds during the interim 2002-2004 period however had their reference levels reduced by a one-off three per cent. Under the entry/exit rules, the introduction of new vessels without public aid requires the removal of the same capacity, that is, on a 1 to 1 ratio. Exits supported by public aid cannot be replaced however. Under these regulations tonnage and engine power measures of capacity remain in force. These indicators still form the basis for new capacity reference levels of fishing fleets, intrinsically based on the MAGP objectives at the end of 2002.

In its 2007 Communication to the Council and the European Parliament, on improving fishing capacity and effort indicators under the common fisheries policy (Commission of the European Communities, 2007b), the EU commission provides input to the debate on the most appropriate way to quantify fishing capacity and fishing effort in the framework of the Common Fisheries Policy. The Commission concludes that the tonnage of fishing vessels is an appropriate measure of vessel size, and consequently a suitable indicator of fishing capacity. Tonnage should continue to be used to assess the overall capacity of the Member States' fishing fleets. The power of a fishing vessel is also an appropriate indicator of fishing capacity, but the effectiveness of current Community rules is not satisfactory. The procedure for the certification of engine power needs to be greatly improved. The Commission considers that the measures proposed in the action plan may provide a solid foundation on which to base future decisions on whether, when and how fishing gear characteristics should be more widely used as indicators for fishing capacity and thus as management tools within the Common Fisheries Policy.

In its 2008 mid-term review of the CFP the Commission states: there is still considerable overcapacity of fishing power in relation to the fish resources available. The European fishing fleets can in many cases exert a fishing pressure on the stocks which is two to three times the sustainable level. Subsidies have contributed to this. Furthermore, the economic incentives for higher efficiency through technological development are the same in fisheries as in other sectors, but the difference between fisheries and most other sectors is that the fisheries sector harvests a resource which is limited by its very nature. Technological development – in the range of 2 to 4% per year in many fisheries - therefore leads to excessive harvest capacity unless the fleet size is reduced proportionally. The effective harvest capacity of European fishing fleets has therefore, in spite of many years of programmes to reduce the capacity, not been reduced as much as necessary to bring the effective capacity in balance with the resources available (Commission of the European Communities, 2008).

5. DISCUSSION

The adjustment of the capacity of the fleets to their available fishing opportunities and the limitation of fishing effort where it is required for the conservation of fish stocks are key management instruments of the Common Fisheries Policy(Commission of the European Communities, 2007b). In this study we have taken a look at the basic principals of fleet capacity and capacity management and examined how fleet capacity is managed in a number of non-EU countries, compared to the EU policy of fleet capacity management.

FAO defines fishing capacity as the amount of fish or fishing effort that can be produced over a given period of time, and for a given resource condition, by a vessel or fleet, given the technology, fixed factors of production, no restriction on variable input usage, and customary and usual operating procedures. Overcapacity in a fishery, than arises whenever the capacity of the fleet is higher than the minimum required to achieve a target level of sustainable exploitation of the fish stock. In this, overcapacity is perceived as a harmful, long run phenomenon that does not self-correct itself and will persist indefinitely if not addressed.

However, from a pure stock conservation perspective, the existence of excess capacity does not pose any threat provided that the total output of the fishery is constrained to a sustainable level. The existence of excess capacity indicates a waste of economic resources, as, by definition, the same catch could have been taken with fewer boats operating at full capacity. Under such conditions, economic incentives exist that encourage fishers to exceed quota levels imposed, speed up the 'race to fish', and increase capitalisation in a bid to increase individual returns. Hence in fact overcapacity is much more of an economic problem than an ecological. The alternative to increasing investment to maintain catch shares under such a scenario is to exit the fishery. However, the lack of alternative uses of fishing vessels makes exiting the fishery difficult.

The FAO's International Plan Of Action for the management of fishing capacity and the FAO Code of Conduct for Responsible Fisheries, stipulate the necessity for States to take measures to prevent or eliminate excess fishing capacity and to ensure that levels of fishing effort are commensurate with sustainable use of fishery resources. Not surprisingly, the major constraints and issues relating to capacity management that have been identified by Member States (and that are particularly serious for developing countries) include difficulties in finding alternative employment for displaced fishers, pressures imposed by industry (harvesting and processing) not to reduce fleets or catch, difficulties in monitoring-control-surveillance and a lack of institutional capacity to develop and implement capacity management plans as well as undertake the appropriate research required (e.g. stock assessments, capacity assessments; FAO, 2010b).

Looking at the cases from the non-EU countries studied, in all cases the management of the fishing fleet, and in particular the fishing capacity, is perceived as a priority. All countries apply a mixture of input controls and output controls; input controls are those measures aimed at limiting fishing capacity by limiting or reducing the level of inputs used, output controls aim at regulating the amount of fish landed.

In all country cases a leading conservation management principle is the setting of Total Allowable Catches. In addition a variety of market-like instruments, ranging from Enterprise Allocations, Community Allocations to Tradable Individual Quotas, have been introduced as instrument for fleet capacity management. In fact experiences with the application of tradable quota show that this instrument can be effective in reducing fleet capacity.

It is widely acknowledged that buyback programmes, when implemented in isolation, do not arrive at bringing about a long term reduction of the fleet. When used in combination with other instruments, buyback programme can assist in facilitating a fleet reduction. However, the experiences described here for example from the U.S. are that the success of the buyback programmes is rather modest. One can query whether the use of public funds is optimised when utilised in such a scheme.

In addition, the main stay of output measures is the reduction of fish removals and hence stock conservation. If in addition to these output measures, input measures are required, in particular the management of fleet capacity in terms of number of vessels, engine capacity and vessel size, it can be queried whether the output measures have been implemented effectively. In other words, if output measures are effective the size of the fleet in terms of capacity has no significance, as the output measures effectively control the deployment of the capacity.

Availability of data on fishing fleets and fleet development differ greatly between the different countries. In general, quantitative data are not readily available in the public domain. If at all data on fishing fleets are available they relate to total numbers of vessels. Whereas total number of vessels can provide an indication for capacity and capacity development, an analysis of specific developments depends on the specific characteristics of a fishery. It is beyond the scope of this short study to analysis the fleet management system of the different countries in full detail. However, judging from the availability of data, stock data today are widely available and accessible; data for fleets and fishing capacity are not that readily available.

As for the European Union, with its mix of input and output measures under the CFP, it fits in with the general fisheries management practices across the globe. What should be considered, noticing the positive experiences in other countries, is the application of market-based instruments such as tradable quota. When applied, this study shows, they have a positive effect on the restructuring of the fishing fleet. Such tradable fishing rights directly link the output control of species specific TACs to an optimisation of the fishing fleet vis-à-vis the available fishing opportunities.

Especially for the larger countries, with many different fishing regions and differing fishing fleets, we see the development of a management set up and mix of fisheries management instruments tailored to the regional characteristics. This also includes the possibility to establish specific management arrangements for local, traditional rights and practices.

From the perspective of the EU, the entry and exit scheme currently in place provides an instrument for the further management of the European fleets. With the current practice of data collection under the Data Collection Framework and for example with the set of indicators developed by STECF to monitor the balance between available fishing capacity and fishing opportunities, a monitoring of the fleet development becomes much more easy. For an indicative assessment of EU fleet capacity the annual report of the European Commission and the STECF work on developing biological, economic and societal indicators capable of assessing 'balance' between fishing capacity and available resources could provide a useful instrument. Article 11 of Council Regulation (EC) No 2371/2002 stipulates a key obligation in the system of the Community Fisheries Policy, namely that Member States (MS) shall take fleet capacity adjustment measures in order to achieve a stable and enduring balance between their fishing capacity and fishing opportunities. For facilitating the monitoring of their performance in fulfilling this obligation, MS have to submit to the Commission annually a report on their efforts undertaken in the previous year (see Art. 14 of the same Regulation).

Under the auspices of STECF a set of indicators for the balance between fishing capacity and fishing opportunities have been developed. Economic (fleet-based) indicators proposed are the return on investment and the break-even revenue/current revenue ratio; the biological (stock-based) indicators concern the current fishing mortality/target fishing mortality Ratio and the catch per unit of effort; social indicators entail the gross value added and the crew salaries as ratio of minimum or average wage (Commission of the European Communities, 2007a).

The above set of indicators are in combination with data collected by the EU Member States, a practical tool and gauge whether a balance is being achieved between capacity and fishing opportunities. One should bear in mind however that output-based measures of capacity imply comparing actual levels of landings/catches/removals against target levels. This is probably the most useful approach but crucially requires a methodology for estimating capacity according to this definition, as well as a reliable monitoring system. Capacity measures defined in terms of nominal effort (e.g. engine power, gross tonnage) require some idea of the relationship between effort and fishing mortality. Moreover, the economic, biological and societal indicators should not be evaluated in isolation.

However, if one seeks to actively manage fleet development one has to render count of the fact that not only capacity definitions differ between fleets and metiers, but also with technological developments over time, will differ for a single fleet over time. In addition in many occasions the balance between capacity and stocks is not that easily defined. Especially in multi species fisheries defining a long term equilibrium between capacity and stocks, across all metiers and all stocks is rather cumbersome.

In conclusion, although it is widely acknowledged that for each fleet and fleet segment and metier a specific set of indicators has to be used to estimate the fishing capacity; this information is currently not widely available in the public domain. In general information obtainable is limited to the development in numbers of vessels and for example licences and/or permits. However, based on available information we can conclude that on average across the globe the size of fleets in number of vessels has been reduced over the past 15 years.

If one seeks to evaluate the instruments deployed in fishing fleet capacity management in the selected cases one has to consider the effectiveness of the instrument, did the management measure in the end result in achieving the objectives. In addition the efficiency of the instrument, the expenditure of time and effort involved, has to be taken into account.

As for the effectiveness of the application of the several fleet capacity management instruments, a first conclusion must be that each instrument has to be analysed in its proper setting. This implies that the instrument for fleet capacity management is usually embedded in a wider set of fleet and fishery management regulations. Hence no instrument can be singled out as a stand alone tool to fully manage fishing capacity. Secondly, the instruments deployed should be analysed in the context in which they are being used. This means analysing the instrument against the characteristics of the specific fleet and fisheries. Thirdly, the effectiveness of a single instrument is enshrined in the wider outcome of the fisheries management system.

Having said this, overall the conclusion must be that over the past decade across the globe fleet capacity has been reduced. Hence the suite of instruments applied have been successful in managing fishing capacity. However, in the majority of cases still available fishing capacity is perceived to be not in line with available fishing opportunities. Hence, the conclusions must be that the effectiveness of a single fleet capacity management instrument is

not so much an attribute of the individual instrument, but more of the general outcome of the management system, and hence the way in which the instrument has been deployed.

A distinction should be made between those instruments physically limiting capacity (technical measures, limitations on engines, vessel size, gear restrictions) and those instruments limiting the deployment of the capacity (effort restrictions, catch restrictions). For those instruments limiting overall capacity it should be noted that over time, for example as a result of technological development, the fishing capacity of the remaining physical capacity can alter. As for the management of the deployment of capacity, the use of tradable fishing quota is used in many countries and, for example in Iceland, New Zealand and in some countries of the EU has been an effective instrument in bringing capacity in line with available quota.

Overall, deployment of capacity is managed in the frame of a Total Allowable Catch. Technical restrictions, although in cases easy to circumvent, further structure the deployment of the capacity. Market like instrument appear to be effective in fleet restructuring. Cost recovery, as for example deployed in New Zealand, transfers management costs from society to the actual user groups.

A special case is formed by decommissioning and buyback schemes. In the case of the U.S., Canada and Australia specific buyback schemes, at times accompanied with decommissioning schemes, have been deployed. Overall the modalities of such systems consist of government making available a maximum budget for buying back licences. In cases, but not always an additional facility is available for either the scrapping of the vessel related to the licence, of for providing a new destination for the vessel, either in a different sector or in a different geographical area. Usually the permit holders/vessel owners can submit a bid, after which government decides which bids to honour.

According to Clark et al., (2005) buyback subsidies have several severe disadvantages. First, an expensive buyback program may at best remove only a marginal portion of the fishing fleet, as less efficient vessels depart while ''high-liners'' remain in the fishery. Consequently, actual fishing capacity may not decline to a notable degree. Second, upon completion of the buybacks, additional capacity may gradually seep back into the fishery through upgrading of the remaining fleet, necessitating a further round of buybacks. For example, Canada's Pacific salmon fisheries experienced its third buyback program. A third disadvantage centres on the possibility that buybacks may come to be anticipated by fishermen. The anticipation of future buybacks can, and doubtlessly does, lead to greater overcapacity than would otherwise occur.

Hannesson (2004), based on the Norwegian experiences draws the conclusion that despite the at least partial success of the decommissioning program the question remains whether it was at all well taken to use public money for this kind of purpose. The fact that the profitability of the remaining vessels increased due to the decommissioning programs indicates that the industry could have financed the buy-backs itself, through the buying and selling of fishing rights, as in fact has occurred on a substantial scale, especially in the purse seine fishery. The Norwegian government is increasingly relying on this mechanism, through an increased use of the so-called unit quota program, which has many features in common with an individual quota program where the quotas are transferable for the long term.

On a more theoretical level Kirkley et al., (2004) conclude, based on an evaluation of US buyback schemes, that the goals and objectives and available budget have a large impact of the scope and implementation of the programme. Most often the objectives of the buyback programmes are not all that clear, other than apparently trying to remove as much capacity form a fleet given the available budget. Kirkley *et al.*, (2004) argue that given a

certain TAC, whether the remaining fleet is judged against average capacity, full technical capacity or full capacity utilisation has a direct effect on the optimal size of the remaining fleet.

Hence as stand alone instrument, buyback schemes prove to be of little assistance in structurally reducing fishing capacity. In fact, buyback schemes usually are part of an array of fishing fleet management instruments such as taxes, permits, licenses, market and rights based management, individual transferable quotas, technical measures and limitations on access or gears. Although helpful in a one-off reduction of capacity, overall these buyback programmes are inefficient in long term fleet capacity management and do not address the economic incentive driving capacity development.

Bearing in mind that each set of capacity management instruments has to be tailored to the characteristics of a specific fishing fleet, overall the conclusion must be, based on experiences so far, that market based instruments are perceived to be the most appropriate tool for capacity adaptation. In Iceland and New Zealand the tradable quota system is perceived as the single fleet management instrument, in the other cases tradable quota or fishing rights are part of the wider fleet management toolbox, such as license limitation and conventional harvest restrictions in the U.S., the Norwegian limitation of access through licensing, technical regulations such as a discard ban and closed areas, and the Australian input controls including time based controls, such as seasonal closures; location based controls, such as area closures; entry based controls, such as licensing; and gear based controls, such as net limits and boat size limitations.

Since the inception of the International Plan of Action for the Management of Fishing Capacity efforts have been put in devising systems for fleet capacity management. The worldwide experiences with capacity management provide useful insights also applicable to the EU. Main lesson drawn is the consideration of applying market based instruments in fleet capacity management. On the other hand the consideration that overcapacity is much more of an economic concern than that of a conservation issue; with a proper monitoring and control of output regulating instruments the size of neither the fleet nor its potential fishing capacity matters, but the way the capacity is deployed.

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ISBN 978-92-823-3203-0