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THE COMMON FISHERIES POLICY BEYOND 2002

ALTERNATIVE OPTIONS TO THE TACS AND QUOTAS SYSTEM FOR THE CONSERVATION AND MANAGEMENT OF FISHERIES RESOURCES

Agriculture, Fisheries and Forestry Series

E-7/FINAL

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EXECUTIVE SUMMARY

Causes of Overfishing

S1 Overfishing occurs because the market fails to allocate the economic cost of the resource to fishing companies when access is insufficiently constrained (The Market Failure Problem).

S2 Management measures will ultimately prove ineffective unless all those participating in a fishery adhere to them (The
Free-Rider Problem).

S3 Correcting the Free-Rider and Market Failure Problems is a necessary condition for effective fisheries management and stock conservation.

S4 If a non-pecuniary measure succeeds in conserving stocks in the short-run, a greater incentive to fish is created by the presence of the now more-valuable resource. This leads to investment in fishing capacity which reverses the improvement in the stock.

S5 Even management systems which allocate property rights or charge fishing companies may cause undesirable effects in the redistribution of income and employment.

Objectives of fisheries management

S6 Legitimate objectives for fisheries management are therefore correction of the free-rider problem and of the market failure, and correction of undesirable redistributional effects. Stock conservation is a consequence of effective management and fundamental to the continuance of the economic activity.

S7 To be successful a fisheries management system must foster economic efficiency, while ensuring effective enforcement of regulations and accurate scientific assessment.

S8 Whichever level is chosen, fisheries management encompasses four fundamental roles. These are definition of fishing rights and management rules, creation of mechanisms to allocate fishing rights, enforcement of fishing rights and management rules, and co-ordination with other management authorities.

S9 A plausible and attainable objective would be to secure a stable, sustainable, and profitable industry.

Scientific basis of fisheries management

S10 In most fisheries there is virtually no relationship between the size of the spawning stock and recruitment of young fish to the fishery. Environmental factors are more important determinants. Recruitment may be extremely variable.

S11 Identifying a precise level of fishing or fishing mortality which optimises economic or physical yield is not possible due to natural fluctuations in recruitment. Trying to attain such a level implies a degree of central planning of business activity by government unusual in western liberal democracies.

CFP structure and coverage

S12 The Council of Ministers has provided a forum for negotiation and agreement among member states but the Common Fisheries Policy (CFP) has been driven by an inadequate scientific approach. Nevertheless, the CFP could provide a framework in which successful fisheries management could take place.

S13 The CFP has had four strands; conservation policy (Total Allowable Catches (TAC) and quotas, and technical measures), structural policy, marketing policy, and third country relations. Member states may apply their own measures in addition.

S14 Mediterranean countries are not covered by the CFP TAC and quota regime and TACs are set for only very few stocks, mainly for major stocks fished in high seas areas, such as bluefin tuna.

S15 In Northern Waters 200 mile EEZs were declared, but in the Mediterranean this has not occurred.

S16 The emphasis in the Mediterranean upon fisheries management within national coastal zones is largely explained by stocks mainly being concentrated within these zones.

S17 CFP objectives include achieving sustainable fishing, avoiding undesirable redistributional effects on communities heavily dependent on fishing, and contributing to economic and social cohesion in the context of the single European market.

Evaluation of TAC and quota systems

S18 The CFP TAC and quota system has failed to conserve stocks. The Commission argues that TACs were set too high by Member States for short-term political reasons. Even these TACs have not been observed. They may have prevented a more rapid deterioration but this is impossible to prove.

S19 The TAC and quota system exacerbates the race to fish between vessel operators, promoting over-capacity ("capital stuffing"), increased harvesting costs, gear conflicts, unsafe harvesting practices, shortened fishing seasons, reduced average landings prices, and associated negative impacts on onshore sectors.

S20 The TAC and quota system also provides an incentive for vessel operators to falsify their landings declarations. Apparently widespread misreporting has resulted in the quality of official landings statistics being highly questionable in many Member States. Poor data makes stock assessment inaccurate.

S21 The CFP TAC and quota system necessitates discarding of fish for which a vessel has no quota or no remaining quota. In some years for some species, up to 50% of catch by weight is thought to have been discarded, though much will be fish below the minimum landing size. Also, the current calendar-year TACs are out of phase with some stocks.

S22 Allocation keys initially negotiated on the basis of historical fishing patterns and codified in terms of relative stability have been undermined by quota-hopping.

S23 Relative stability is expected to be retained after 2002, thus limiting free access of all EU vessels to all EU waters, set out in the Treaty of Rome.

S24 Experience of TAC and quota systems worldwide shows that they have generally been insufficient to prevent stock decline.

Evaluation of other output controls

S25 Quota fees are intended to correct market failure by increasing individual vessel operators' harvesting costs to cover the economic cost of the resource. Unpopular with vessel operators, they provide an economic incentive to counter tendencies for the development of overcapacity, while contributing to public finance and meeting management costs.

S26 Individual Transferable Quota (ITQ) schemes are intended to correct the market failure and allow the market to adjust the amount of fishing to the opportunities available. An economic incentive is provided to eliminate overcapacity and encourage compliance.

S27 Where ITQs, licences or other fishing rights are initially given free they tend to acquire considerable value to the companies concerned and make entry into the fishery more costly to prospective vessel operators.

S28 Transferable fishing rights provide a means of decommissioning vessels without the taxpayer being required to provide the funds. However, while the vessel owners are compensated, there is no provision for crew members.

Evaluation of input controls

S29 Due to administrative simplicity, licencing systems restricting entry are one of the most prevalent types of input control used in fisheries both within and outside the EU. Where no charges are made, licencing systems have generally proved ineffective in preventing input growth of national fleets and achieving fisheries management objectives, owing to capital stuffing and input substitution.

S30 Structural measures to create a fleet which matches available fishing opportunities have been largely ineffective. Owing to definitional problems concerning capacity and remaining opportunities for capital stuffing and input substitution, such measures generally fail to constrain fishing inputs, while producing unintended distortions in the production techniques.

S31 The Lassen Report has recently advocated more of the same measures that have consistently failed in the past apparently believing that it was the degree of application rather than the nature of the measures that has led to their failure.

S32 Although effort controls such as days-at-sea limits have not yet been widely tried within the EU, experience has shown that they are also largely unsuccessful. Effort can only ever be defined incompletely in terms of measurable characteristics of vessels, gear, fishermen and activity. Scope always remains for increases in unrestricted inputs, while such measures fail to address economic incentives for vessel operators to try to increase catching effectiveness.

S33 Effort controls with no pecuniary element will ultimately be ineffective. While easily enforceable, capital stuffing will frustrate them unless an appropriate charge for access to the fishery is made or a private property right allocated.

Evaluation of technical measures

S34 The wide range of technical measures used including minimum landing sizes, mesh sizes, area and time closures also have been largely ineffective. Minimum landing sizes (MLS) aim to protect juvenile fish by encouraging fishermen to focus their activity away from nursery areas. However, to the extent that fishermen are unable to prevent themselves catching small fish, they result in increased discarding.

S35 Closed areas and seasons have not conserved stocks but have promoted capital stuffing.

Importance of national and regional factors

S36 Management regimes in the Falkland Islands (licence fees), Iceland (ITQs), Namibia (quota fees), and possibly New Zealand (ITQs) appear to have succeeded so far in promoting more efficient fisheries with adequate stock conservation subject to the quality of stock assessments. However, all of these are examples where fisheries fall within a single jurisdiction, with much reduced enforcement difficulties.

S37 Similarly, within the EU there have been some successes in management of localised coastal stocks. In the Netherlands allocation of property rights to mussel fishermen has led to spectacular growth in production and profitability, although the mechanism used has led to them becoming millionaires, creating almost insurmountable financial barriers to new entrants.

The future of the CFP

S38 The EU has conceded the principle of rationing by charging. Provision currently exists for charging EU vessel operators for access to fishing opportunities in third country waters, for example to Moroccan waters.

S39 Introducing charges in EU waters is perceived by the Commission to be politically unacceptable to the Council of Ministers. The Commission therefore does not consider it productive to make proposals for such charges to be introduced.

S40 The Commission expects the Treaty derogation providing for national 12-mile coastal zones to be perpetually renewed.

S41 Given the concern expressed over the condition of some spawning stocks, notably cod and herring in the North Sea, it would appear inadvisable to leave significant changes to fisheries management until the 2002 review. A gradual implementation may prove more effective in the long run.

S42 That the European Union's fisheries are shared between Member States is inescapable. It is surprising that more effort has not been put into obtaining effective fisheries management, given that success could have been used as a flag-bearer for the success of Europe as a political institution.

Alternatives to the existing CFP TAC and quota system

S43 The presence of a TAC and quota system in the CFP is not in itself undesirable since several management systems rely on TACs. However, it is widely acknowledged that there has been a general failure of the existing CFP TAC and quota regime and its enforcement.

S44 Despite considerable potential for devolving management to rights holders in some local fisheries, in most cases the ultimate responsibility for ensuring effective fisheries management remains in the hands of governments.

S45 Fisheries management comprises both a system of rules and a management structure encompassing methods of decision-making, administration and enforcement, which can also be important in determining management success. A management structure is most likely to be accepted if it incorporates co-management with vessel operators.

S46 Simplicity of management structure, transparency of scientific assessments and decision-making processes, perceptions of equitableness and of full compliance by other vessel operators are all important factors in gaining acceptance of a system.

S47 Management could be undertaken on a European, regional (supranational), national, or local basis. However, a strong case exists for a more integrated approach with greater coordination at European or regional level in order to ensure equitable regulation and enforcement.

S48 In line with the subsidiarity principle, more localised management to ensure that only participants in a particular fishery are involved in making management decisions can be used to more closely tailor the system to the characteristics of the fishery.

S49 Quota fees, tendered quotas, individual quotas, ITQs and Regional enterprise share quotas all require the retention of a TAC and quota regime. TACs must be set on the basis of sound economic and scientific advice.

S50 All TAC and quota systems tend to exacerbate discard problems.
S51 Only quota fees, tendered quotas, ITQs, royalties, state monopsony, and seabed plots are systems which can overcome the market failure problem. Due to transfer restrictions Regional enterprise share quotas could be only partially successful in overcoming market failure.

S52 Perpetual licences, tendered licences, tradeable days at sea, and input taxes could be only partially successful due to input distortions caused.

S53 State monopsony, royalties and input taxes may not be considered politically tenable.

S54 The applicability of seabed plots is limited to sedentary shellfish fisheries. Quota fees, tendered quotas, and ITQs are the main alternative systems which are to be preferred on grounds of economic efficiency and widespread applicability. In view of their administrative simplicity tendered licences are also added to the list of main alternatives.

S55 The choice of a management system to eradicate the market failure problem is particular to each fishery. Detailed discussion is necessary to define the fishery concerned and to determine the most appropriate management system.

Transition to an alternative management system

S56 In all cases a relatively slow transition to the full operation of a new system is recommended in order to allow adequate time for economic and socioeconomic readjustment. In most cases a twenty year time frame is preferable.

Resolution of Conflicts

S57 Conflicts of activity can be resolved through a market mechanism where one group purchases from others the exclusive right to a fishing ground.

I STOCK CONSERVATION AND THE CAUSES OF OVERFISHING

Stock conservation is essential to the economic survival of a fishery. However, there is a number of factors which mitigate against effective conservation when access to a fishery is insufficiently restrained.

The fishing industry is faced with an extra constraint not faced by most industries in that the resource is limited relative to the quantity used in producing output but is also self-renewing.

Overfishing comes about as a result of two problems well known in other industries.

The first is a failure of the market to allocate a price to something which has an economic cost. This occurs where an activity produces an external cost or burden borne by another, sometimes called an externality. Pollution is the prime example, but there are others such as traffic congestion, and the provision by the State of health and education services in European countries are examples of attempts to overcome a different form of market failure.

In fishing the activity of individual vessels reduces the fishing opportunities for others and future income generally is lost because young fish are not given time to grow before being caught. Ultimately, if the spawning stock is severely depleted, the stock may be reduced to levels which are uneconomic to fish.

Ending or significantly reducing fishing on a species does not ensure its recovery, because the ecosystem may reach a new equilibrium with the space occupied by one or more other sea creatures, or because the relative abundance of predators curbs the recovery.

Normally in industry, production settles at the level where the cost of producing an extra unit of output begins to exceed the price received for it. However, the fisherman has no incentive to equate this cost to the loss of future income to the fleet from overfishing and so cannot recognise the economically efficient point at which to limit production.

This situation is exactly analogous to that of a traffic jam. Sitting in a traffic jam imposes a cost in time on drivers without the cost having a financial form. Fishermen are often accused of being greedy yet few people would level the same accusation at road-users. However, like fishermen they are merely over-using an asset because the market does not ration its use by price as it would with a private resource.

This market failure produces a race to fish. Individual vessels try to take as much from the stock as possible before others reduce the catch rates by the sum of their efforts.

The absence of a clear property right in the stock or of a charge for fishing to internalise the externality is at the heart of the problem. The result is lower than economically optimal stock levels, and a progressively declining average age of the stock and landings, leading to discarding of large numbers of unmarketable small fish and a declining spawning stock.

The second problem which mitigates against prudent use of fish stocks is that of the free rider. If one fishing company tries to reduce its activity in order to conserve stocks its action will serve only to leave more for those who remain fishing. Where stocks are shared among nations this problem means that unless all those nations apply an equitable, if not exactly the same, system of management then little can be achieved.

Gulland (1988) noted that the cost of fisheries management may be so high that it exceeds the profits obtained from a fishery and may approach the total value of the catch. This highlights the importance of considering cost in devising an effective management regime.

Stock conservation has been seen as the prime function of fisheries management. This has meant that a constraint on the pursuit of an economic activity has been mistakenly treated as an objective.

Theoretical objectives might be to obtain the maximum economic yield to society or the maximum sustainable yield, but such optima are in reality constantly changing, unknown, invisible, and incalculable with precision. Because of the natural fluctuations in recruitment and other environmental and economic factors they are unattainable.
A second best approach is needed. In general, western liberal democracies governments do not set output targets for industries. They try to create conditions in which industry can flourish. It follows that in fisheries a reasonable and attainable objective is to create stable, sustainable, and profitable fisheries.

To do this it is necessary to overcome the free rider problem, correct the market failure and allow the market to perform its function of deciding the size of the industry and the level of production subject to economic, socioeconomic and stock constraints. If this is done stock conservation becomes a consequence of effective management and is of course fundamental to the sustainability of the fishery.

The market failure can be largely corrected by allocating a property right in fishing or the stock, or by charging for access to the stocks. Even where a property right exists, however, owners with a high discount rate may lead to a fishery being overfished. The higher the discount rate the greater the preference for the returns from an asset sooner rather than later.

In addition, management systems which allocate a property right or charge fishing companies may cause undesirable effects in the redistribution of income and employment and on the second generation of vessel operators.

Stock depletion is an emotive issue but the reality is not as generally assumed. It is commonly believed by the scientific community that there is virtually no relationship between the size of a spawning stock and the numbers of young fish which recruit to a fishery though there are notable differences in emphasis (see for example, Holden 1994, Ricker 1954, Wooster and Bailey 1991). Fish are said to recruit to a fishery when they join the adult stocks.

A handful of spawners is usually capable of producing enough eggs for a full recruitment. After the eggs are laid, however, a panoply of other environmental factors such as water temperature, sea states, the availability of food, predation, and cannibalism, *inter alia*, all have their influence on recruitment and are normally much more significant in determining the level of recruitment.

Nevertheless, there seems little question that the lower the size of the spawning stock the higher the risk of a recruitment failure (Myers and Barrowman 1994). Thus nature produces a nearly random number of young fish each year and it is then up to the fishermen to make the most of them.

The level of error in stock assessments makes it harder for those involved in the political process to acknowledge the general reliability of scientific comment when faced with a potentially unpopular cut in TACs. Nonetheless, some spawning stocks including North Sea cod are currently below the minimum biologically acceptable level (MBAL).

Statements by scientists to the effect that a fish stock is at its lowest usually refer to the spawning stock only. Because recruitment is only weakly related to the size of the spawning stock, normal numbers of young fish may still come into a fishery when the spawning stock is low. This explains why scientists can complain that (spawning) stocks are low but fishermen who are largely not catching spawners are unable to see any fast decline in their catches. In essence, they are not talking about the same thing.

In the Mediterranean scientific assessment of stocks is less comprehensive fisheries management has often consisted of rules enforced by social or peer pressure as in the Spanish *Cofradias*. The CFP TAC and quota system does not apply to the Mediterranean.

Fishermen's frustration with the Common Fisheries Policy is understandable because it seeks to curb their competitive activity and has imposed numerous regulations while failing to conserve stocks.

The problem with past advice to the Commission and member state governments is that all too often it ignored the critical fact that fishing is an economic activity. The advice has suggested controlling fishing by making it less efficient instead of using the market mechanism so that fishermen bear the full cost of their activity.

Two recent examples show the importance of economic incentives in fisheries and of understanding them. In Denmark, a system of constraint of fishing activity by limiting the number of days a vessel may spend at sea is being tested. The short-run value to vessel operators breaking the regulation is significant. Anecdotal evidence suggests that in the United Kingdom some vessel owners wishing to leave the industry have found it more profitable to sell their licence and track record, leaving most of the capacity in the industry, than to accept decommissioning grants.

Only economics has explained why overfishing occurs and only an economic solution will succeed in conserving both stocks and a fishery at the same time. A variety of such solutions which can be used according to the characteristics of a fishery. These include licence systems which involve a charge for the licence, quota systems which allow the quota to be owned and transferred at a price, and royalties imposed on landings. All of these are possible within the existing framework of the Common Fisheries Policy.

Fishermen, however, recognise only that these increase the costs they face. It is little wonder that they do not see the benefits that would accrue from effective management because they have not really been effectively explained.

In order to bring fishing capacity into line with available stocks some fishermen will leave the industry. Unless something is done to compensate them they will bear an unfair redistributional effect while those remaining in the industry and government revenue benefit. Politically, this is a most important side effect.

Rather surprisingly, the European Union has missed a perfect opportunity to show where international cooperation could work. The international character of many of the Union’s fisheries is inescapable, and without all the nations which share fish stocks imposing a fair system of control on their own fishermen there is little that an individual nation can do. International action is a prerequisite to proper management of any shared fishery.

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II ANALYTICAL BACKGROUND

Typology of Fisheries, Stocks and Institutional Environment

The initial section of this Section provides a typology of fisheries stocks and institutional environment. Brief explanation of the principal categories used is useful as the differences are generally reflected in the way in which fisheries are managed.

Fisheries are essentially of two types, either wild capture fisheries, or aquaculture (fish farming). However, there are some interactions between the two, with fish ranching on-growing fish caught from wild fish stocks in fish farms, and stock enhancement programmes which breed fish in hatcheries for release in order to increase the biomass of wild stocks. Within the EU, the four principal species produced by the aquaculture sector are trout, mussels, salmon and oysters, accounting for over three quarters of total output value of 1,511 million ECU in 1991 (DGXIV 1994).

While some fisheries are essentially single-species in that only one species which is commercially marketed is caught (e.g. the tuna longline fishery), others are essentially multi-species as in many of the Mediterranean fisheries (Placenti *et al* 1992), with a continuum of fisheries lying between the extremes.

Depending upon the average size of the vessels involved, human consumption fisheries sometimes categorised as small-scale artisanal, or large-scale. In so-called industrial fisheries the target is of non-human consumption species but there may be a
by-catch of other species.

From a fisheries management perspective, target fisheries are those where fishermen aim to fish the particular stock under consideration (e.g. the purse seine herring fishery). By-catch fisheries are those where fishermen fish principally for other stocks, so that the catch of the particular stock is more incidental (e.g. catches of herring by the industrial fleet).

While some fisheries are prosecuted using a single gear type, many fisheries are multiple gear with more than one gear type being used to catch fish from the same stock as in many of the Mediterranean fisheries (Placenti *et al op cit*).

Mobile gear fisheries include trawling, dredging, seining, and purse seining. Static gear fisheries include gill nets, pots and creels. Static gear can often be left fishing while the vessel moves to set or haul gear elsewhere, or returns to port.

Demersal stocks (e.g. cod, haddock, plaice, sole) generally live on or near the sea bed. Pelagic stocks (e.g. herring, mackerel) are generally found nearer the surface and often in large shoals. Shellfish include crustacea (e.g. crabs, lobsters) and molluscs (e.g. mussels, oysters), with many species commanding a relatively high price per tonne.

Sedentary stocks are ones which remain in one place (e.g. molluscs), whereas migratory stocks move between areas (e.g. herring, mackerel, and capelin), travelling in some cases hundreds or even thousands of kilometres (e.g. Bluefin tuna). Stocks can be placed in a continuum between these two extremes.

Most EU fisheries prosecute single jurisdiction stocks which live entirely within a single Exclusive Economic Zone (EEZ) coming under the auspices of a single fisheries management authority.

Nevertheless, some of the most valuable fisheries are based on stocks shared with other member states or third countries.

Some fisheries prosecute stocks which live partly within more than one EEZ and are subject to the jurisdiction of more than one management authority (e.g. Herring and Mackerel which migrate between EU and Norwegian waters). A few fisheries in which EU fishermen participate involve High Seas or straddling stocks which live fully or partly in areas subject to incomplete management (e.g. due to not all participating nations being signatories to the relevant Convention).

Typology of Management Objectives

Economic Objectives

The economic objectives that may be pursued by fisheries managers are manifold. Those ultimately chosen are likely to be closely linked to the political philosophy of the enforcing nations.

Managers in western liberal democracies have tended not to set economic objectives related to economic efficiency or profitability, preferring to leave the industry to set its own targets, while attempting to constrain activity to conserve the resource and the fishery based upon it. This approach has been based, however, on a failure to appreciate the nature of the economic problems that cause overfishing.

A basic economic problem to be overcome is that of the free rider. This may be seen as a prime economic objective of fisheries management.

Within nations this boils down to a question of the effectiveness of enforcement of management measures, since it is likely that all fishing enterprises will be subject to the same set of rules. There may of course be conflict between different groups of fishermen where the activity of one group impinges on that of another, but these will be addressed by the internal political process.

Between nations the situation is different. At the very least there will be a different legal and administrative structures and the institutions of fisheries management may differ accordingly in their effectiveness.

At the international level a number of institutions has been established to deal with this by establishing common frameworks or rules. These include organisations such as the North-West Atlantic Fisheries Organisation (NAFO), and the European Union Common Fisheries Policy.

A second basic economic objective of fisheries management is to overcome the market failure. This can only be achieved by the allocation of a property right either in the resource, or in exploitation of the resource or by a charge being imposed for fishing. The rights acquire a value in themselves and any transfer permitted by the authorities will tend to occur through a market mechanism whether encouraged by them or not.

Those countries that have instituted Individual Transferable Quota schemes have responded to this second problem. It is often not recognised, however, that where other means of limitation of access, such as licencing, have been established those means may also acquire a value arising from their scarcity.

Though achieving these two basic economic objectives is necessary for effective stock conservation they depend on access to a fishery or to a stock being sufficiently limited in the setting of, say, TACs or the number of licences.

Other potential economic objectives include maximisation of profits, sales revenue, and output. The problem with such maxima is that they are apt to be unstable owing to environmental and economic factors. Whether they are economically efficient is subjective and depends on the balance of satisfaction derived from competing criteria of success such as profitability and employment levels.

A more important objective has been maintenance of employment. This occasionally has been behind decisions by the European Union Council of Ministers not wholly to accept recommended quota cuts recommended by the International Council for the Exploration of the Sea (ICES) Advisory Committee on Fisheries Management (ACFM) and proposed by the Commission.

Often fishing is located in remote and peripheral areas where alternative employment opportunities are limited. It has been an objective of fisheries managers, particularly the political decision-makers, to retain employment in fishing where a locality demonstrates a significant economic dependence on fishing.

Technical advance make maintenance of employment particularly difficult to pursue, but less strict objectives such as a controlled decline in dependence are more attractive.

Socioeconomic Objectives

An undesirable consequence of effective fisheries management may be a redistribution of income and wealth. For example, measures which conserve a migratory stock may deprive communities which exploit the stock at an early stage in its migration to the benefit of communities further on. Utilitarian arguments that the greatest good of the greatest number is being served find little sympathy in the losing communities unless some means of compensation can be provided.

Institutions which allocate a right to a resource or a fishery may also give the beneficiaries a windfall. This is more a problem for the second generation wishing to buy into a fishery and may be overcome by charging a rental for the right. Nevertheless, avoiding excessive redistributions of income and employment has been a legitimate economic objective.

Biological Objectives

There is a considerable variety of objectives that may be pursued in relation to the biology of the stocks.

The economic activity on a stock may be prejudiced if the spawning stock is allowed to fall below a level sufficient to give a near certainty of a recruitment. Given that environmental factors outside the control of fisheries managers can in themselves be sufficient to cause a recruitment failure it is a question of minimising the possibility. This has to be balanced, however, with the need to keep the fishery active.

Scientists have now developed a statistic called MBAL which is the minimum biological acceptable level of spawning stock biomass deemed necessary to reduce the risk of a recruitment failure to a small and acceptable level. The level of risk deemed acceptable is obviously rather subjective.

The Lassen Report (Lassen *et al* 1996) identifies and defines in detail two subsets of fishing mortality constraints designed to achieve biological objectives; those promoting sustainability and those for yield maximisation.

Fishing mortalities intended to achieve yield maximisation are less clearly biological objectives though they may be defined as such. Maximum sustainable yield (MSY) has been shown to be of questionable applicability (Larkin 1977) and in any case is rather purposeless in that it seldom coincides with the level of landings which produce sustainable long-run maximum economic yields however defined (Cunningham *et al* 1983).

Scientists in recent years have attempted to relate fishing mortality directly to fishing effort and have preferred, instead of offering total allowable catches to achieve the sustainability objectives, to suggest levels of fishing effort deemed to produce a desired level of fishing mortality. Economists have for many years argued that this is fallacious (Hannesson 1994, Valatin 1992, Rodgers 1995).

Essentially, all biological objectives are related to pursuing the sustainability of the fishery by ensuring the survival of the stock. Differences that occur between objectives are usually brought about by the biological behaviour and characteristics of the stocks.

Other biological objectives include the protection of juveniles to allow them to join a fishery and to encourage replenishment of the spawning stock, and preservation or improvement of the age structure of the stock, again with the spawning stock in mind, but also with the intention of increasing the yield by allowing young fish to grow.

Secondary objectives include preservation of the biodiversity of the ecosystem and maintenance of the ecological balance among the species of fish and other marine creatures.

Typology of Management Measures

Fisheries management measures can be classified as one of three types. Output controls aim to constrain the amounts of fish caught or landed. Input controls aim to constrain the economic and physical inputs used to catch fish. Technical measures aim to influence relationships between inputs and outputs.

Measures can be further categorized according to level at which they apply (e.g. to the fleet as a whole or at individual vessel level, single species or multi-species, etc). The time period to which measures relate also differs (e.g. calendar year,
multi-annual, season, multi-season, etc), as well as the area covered (e.g. within a given ICES area, "box", 12-mile coastal limit, etc).

Measures can also be classified according to the extent to which different means are employed to achieve their objectives. Often regulations require vessel operators to meet specific standards, or restrict their production within given bounds.

In some instances indirect means are used to achieve management objectives, relying upon economic incentives and the operation of the market. Not only fisheries-specific regulations, but also those applying more widely, such as tax and depreciation rules, can provide powerful incentives which influence vessel operators' investment and production decisions.

Output controls aim to restrict the quantity of fish landed with a view to ensuring that stock conservation objectives are met. At fishery level the main output controls are Total Allowable Catches (TACs) and national quotas. At individual vessel level, output controls include a wide range of individual vessel catch limits and quota systems, differing according to characteristics such as the degree of transferability.

There can be intermediate levels of output control too. For instance, in the UK quotas may be allocated initially to Producer Organisations (POs). In Alaska and some other non-EU countries quotas are allocated to particular communities.

Moratoria are necessary complementary measures to TACs, as even in the more usual case of non-zero TACs, there is generally a closure of the fishery once the TAC for the year or season is reached.

Discard rules are a further form of output control which aim to regulate the relationship between levels of catch and landings. In many EU fisheries, once the quota for a particular stock is caught, any further fish from that stock caught have to be discarded. Where discarding is banned (e.g. Norway), other mechanisms are required to resolve potential mismatches between the ban and TAC restrictions.

Input controls aim to restrict the amount of fishing which occurs and have become increasingly popular within the EU, despite the complexity of the input-output relationships in fishing. These relationships can be subject to significant variations between areas and over time.

At fleet level input controls include licencing and fleet capacity restrictions. At individual vessel level, input controls include a wide range of individual vessel effort limits, differing according to characteristics such as how effort is defined and the extent to which individual allocations are transferable. They may relate to vessel size, length, the power of the engine, or the time spent at sea or fishing, *inter alia*.

Technical measures which apply at individual vessel level include minimum mesh size, mesh configuration (e.g. square mesh), and
by-catch regulations aimed at reducing mortality of juvenile fish and non-target species. In many fisheries there are minimum landing size regulations which aim to dissuade fishermen from fishing nursery areas, or targeting other aggregations of juvenile fish. Other technical measures include those relating to onboard handling and storage of fish aimed at maintaining fish quality standards, vessel safety and monitoring.

Despite the close relationship between moratoria and TACs, the prevailing convention of classifying closures as technical measures, rather than output or input controls, is followed in this study. Short closures (e.g. seasonal) and selective closures (e.g. applying only to certain classes of vessels) are commonplace. Selective closures often relate not purely to stock conservation, but to socioeconomic or distributional objectives (e.g. protecting artisanal fishermen).

Sex selectivity measures are intended to protect valuable brood and spawning stocks. A notable example is a prohibition of landing berried hen lobsters. Unfortunately they depend on the goodwill of fishermen who can easily wash off the eggs unless a procedure such as v-notching (clipping the tails) is instituted.

Compliance

Compliance is a key feature necessary for the success of any management measure. Achieving it is also a fundamental part of a management regime.

Compliance can be considered both at individual vessel level, and at higher levels of aggregation (by fleet, country, etc) where conflicts of interest can arise between enforcement and management aims. The extent of non-compliance depends both upon expected economic incentives entailed in non-compliance and upon factors such as morality and perceived legitimacy (e.g. fairness) of the measures.

However, penalties imposed for non-compliance generally provide incentives to hide such behaviour, hampering accurate measurement.

In terms of output controls, non-compliance involves
mis-reporting the true level of landings or catch. In general the tendency exists for landings to be under-reported in order to circumvent quota constraints. However, where vessel operators are unable to fully catch their quotas, or in emerging fisheries not yet subject to quota restrictions, incentives can exist for the level of landings to be over-reported. For example, the anticipated use of historic performance criteria as the basis for allocation of future quota shares provides this sort of incentive.

In addition to failure to report the true level of catch or landings, the species composition of the catch or landings may be misreported in order to circumvent specific quota restrictions, or maximum by-catch rules. Similarly, the location at which fish is caught may be misreported in order to circumvent quota restrictions, or closures.

In terms of input controls, non-compliance includes circumvention of licencing regulations by vessels fishing without meeting the required licence conditions. This can involve fishing without a licence at all, or without the type of licence required for fishing a given stock, area, using a particular gear, or particular class of vessel. Similarly, non-compliance with effort restrictions may relate to circumventing overall effort levels, or be specific to a particular fishery. Capacity restrictions can be circumvented by misreporting vessel characteristics.

Non-compliance with technical measures includes evading minimum landing size regulations, and using gear which does not comply with required standards or deployment. (E.g. using car tyres in trawl nets to reduce the effective mesh size.)

A variety of methods is used in order to monitor compliance, from inspections at sea and onboard observers, to log books completed by vessel operators detailing landings by species and area of capture, to quayside inspectors. Monitoring compliance is costly, often representing a significant proportion of fisheries management costs, making enforcement costs an important consideration in choosing between management options.

Compliance with management measures may also entail significant costs for vessel operators. This generally reduces their profitability and can impair international competitiveness.

Measuring Successful Management

Indicators to measure the success of management measures relate to the objectives chosen initially, but may go further in providing a broad overview of the health of a fishery.
As such a general, if imprecise, objective such as that of a stable, sustainable, profitable industry requires a broad range of statistics from the financial, economic, and biological spheres.

Financial Indicators

These are among the simplest and most accessible.

In particular the gross sales revenue is relatively easy to collect and readily understood. However, the point of collection of revenue data is important. Revenue data from log books will be incorrect to the extent that landings are not reported correctly. Revenue figures derived from cost and earnings surveys are less likely to suffer from misreporting but may do so if fishermen are under-declaring their income for tax purposes.

Financial Profits are also well understood but suffer considerably as an international comparative tool because the very significantly different rules that apply to taxation of profits lead them to be disguised, hidden, and variously reallocated in order to minimise tax liability. This also makes it difficult to know whether a fishery is more profitable than it appears to be.

The degree of political agitation for subsidy is something of an artistic measure but serves in some degree as an indicator. The more pressure the catching sector is under, the more likely there are to be appeals for government assistance.

Economic Indicators

Adequate economic data on fisheries is collected in very few countries. Where the data is available it is possible to make estimates of the potential economic (social) rent available from a fishery and to assess how far current practice has placed a fishery from that optimum, though such optima are necessarily imprecise.

Economic profits are simpler to measure than economic rent. They may be estimable even where detailed cost and earnings data do not exist, if data are available on the quantities of the principal inputs used (principally, vessels, labour and fuel).

Fish Stock Indicators

The fish stock indicators available provide some measure of the success of management measures from the point of view of conservation.

Time series of stock and spawning stock sizes and the age distribution of the stocks all serve to highlight trends in the resource, and therefore the appropriateness of past measures and to some extent also of proposed measures. The problem, however, is that data on many stocks of importance are limited, with many stocks not being subject to any assessment.

Where available, assessments can be set against the MBAL of the stock and the impact of management measures judged. Of course, management measures themselves are not the sole cause of a given stock level and thus their effectiveness cannot be judged strictly by the level and trends in stocks. In order to cope with the dynamic nature of the stocks, scientists prefer to recommend reference fishing mortalities. These offer a measure of the limits within which fishing may take place if a stock is to be sustainable.

There are other problems with using fish stock indicators besides the absence of stock assessments. Those assessments carried out are subject to varying degrees of reliability arising from the resources devoted to the assessment and the behaviour of the stocks. Landings data used in the assessment process is particularly prone to error since even where there is no misreporting there is very little information available to scientists on the extent of discarding.

Landings data is corrupted to the extent of illegal and misreported landing as well as by normal measurement errors and this has become such a problem in the European Union that the scientists have been forced to adjust official landings data before they can complete their stock estimates (ACFM 1995).

Measuring Successful Management

Socioeconomic Indicators

Although not directly related to economic indicators, levels of employment in different sectors of the fishing industry are generally viewed as important indicators of its health.

Numbers employed (full-time, part-time, or corrected to full-time equivalent) and numbers of vessels are frequently used to indicate trends. However, there may be difficulties in interpreting these indicators.

Increases in technical efficiency over time and new investment tend to reduce the number of fishermen and vessels needed to harvest any given level of catch. Thus, if management measures are successful in terms of stabilizing catch levels, some contraction in employment and the number of vessels might be expected. This implies that where a fishery moves from being under-exploited to being more fully exploited, stability or a sustained increase in employment may be taken to indicate a healthy sector and signify management success. Increases in employment may, however, indicate that a fishery is moving towards over-exploitation. Where a fishery is already fully exploited, falls in employment corresponding to increases in technical efficiency can be compatible with a healthy sector and signify management success.

As in other industries, measures of industrial concentration may be used to indicate the extent to which a healthy competitive environment exists, or monopoly profits are being earned. In this regard, the percentage of output produced by the largest companies or trends in the number and relative size of companies may be used as indicators.

As the industry is a major employer in many of the more peripheral coastal communities, the regional distribution of fishing enterprises and the associated employment and multiplier effects on the onshore economy is usually also of considerable interest.

Trends in number of companies, employment, or numbers of fishing vessels may be used as an indicator of the health of the industry and of social wellbeing in regions with a high level of dependency on fisheries.

Overall Measures

The above discussion shows the diversity of indicators used to measure management success. Frequently individual objectives are not wholly compatible, thus requiring trade-offs to be made between policies aimed at achieving different goals. Allocational issues are frequently particularly fraught, with different regions and user groups vying for an increased share of available fishing opportunities.

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III THE COMMON FISHERIES POLICY

Objectives: Short-run and Long-run

During the initial stage of the Common Fisheries Policy it was subject to some criticism that its objectives were vague, seeking only to conserve fish stocks and fisheries. Objectives could however be identified from the specific policies introduced within the general framework of the CFP.

In this way, the CFP echoes the approach of constraining activity taken in many other major fishing nations. It has not sought to emulate those countries like Iceland, New Zealand and Australia which have set out to correct the market failure and reverse the detrimental impact of the economic disincentive to conservation created by inadequately limited access to a common resource.

Since the review of the policy in 1991, the objectives have been explicitly stated (European Commission 1991)) as:

a) to achieve sustainable fishing
b) to avoid undesirable side effects on fishing communities heavily dependent on fishing
c) to secure stable supplies to consumers at reasonable prices
d) to contribute to economic and social cohesion in the context of the single European market.

These may be viewed as a set of long-run objectives. Towards achieving them a number of shorter term goals exists:

a) to reduce the amount of fishing from current levels to those consistent with sustainability of fishing
b) to reduce the size of fleets to levels consistent with those permissible by the requirement of sustainability
c) to reduce employment in fishing in a controlled manner and to provide alternative work in areas highly dependent on fishing.

Principal Components of the CFP

The CFP has a number of elements which seek to achieve the basic objectives.

The first of the four elements of the CFP is conservation policy which includes the TAC and quota system and technical conservation measures. The TACs are set annually for a calender year. The TAC and quota system originally applied to stocks considered to be under pressure but was extended to include the Precautionary TACs where there was inadequate data on stock levels (Holden 1994). The Commission now has power to allow more flexibility in the TAC system by setting multi-annual or multispecies TACs if it feels they would be an improvement. Some TACs are already multispecies in that they cover a number of closely related species, e.g. megrim, monkfish and anglerfish, and horse mackerel.

Allocation of the TACs among member states was carried out according to a key determined by historic exploitation of the stocks. This has been codified in the principle of relative stability. Relative stability

seeks to ensure that the share of fishing of stocks among member states is maintained at the levels prevailing when the CFP was set up or when new members states joined the EU.

Technical conservation measures are designed with a number of objectives in mind. Normally they relate to the design or use of fishing gear. They may be directed at conserving spawning stocks and limiting the number of small, perhaps unmarketable, fish caught. They may protect nursery grounds. They may be set up to protect other marine species.

The second element is the structural policy. The Multi-Annual Guidance Programme (MAGP) seeks to reduce fleets to a size consistent with the available fishing opportunities. In order to achieve this grants have been made available for decommissioning vessels if supported by national funding.

Any attempt to relate fishing mortalities to capacity has been done on the crude assumption that fishing mortality is directly analogous to fishing effort. The Lassen Report (1991) is no different in this except that it takes a longer view of spawning stock levels. This approach is unsound, however, because it neglects the importance of substituting different inputs from those in the definition of fishing effort used, and ignores the economic incentive created by the presence of rehabilitated stocks.

A second area of the structural policy is to encourage the refurbishment and development of the infrastructure of the industry and its localities. In order to ease the impact of reductions in fleet capacity on employment and income in coastal areas the European Union has established the Pesca funding initiative which assists retraining and the establishment of pilot projects to re-employ labour displaced from the fishery.

The structural policy seeks both to remove vessels from the fleets but also to modernise the fleets. As part of a policy to create an efficient safe fleet there is no immediate conflict in these two strands although they do have a contrary effect on capacity. It does of course mean that the number of vessels to be decommissioned is increased because of the increase in effective fishing power of newer vessels.

The third element is the Market Policy which seeks to stabilise markets, secure supplies, and ensure that prices to the consumer are reasonable. This was to be achieved by establishment of Producer Organisations, common marketing standards and pricing systems, and a system of trade with countries outside the Union.

The Producer Organisations have as an objective to manage supplies among their members in such a way as to provide stability of supply. In practice, this has been achieved only in limited areas, normally where there are strong community ties which offer an additional layer of discipline. In Spain, an effective case has been made that the *Cofradias*, fishing guilds, already achieve what the POs could hope to (Franquesa and Lostado 1994).

Common marketing standards have led to establishment of a common size grading system and hygiene standards applicable to the whole EU.

These elements come with the basic principles of unification of European Union markets and Union preference, but were tempered by the principal of relative stability.

The fourth area covered by the CFP is third country agreements and international Conventions.

The European Union conducts bi-lateral discussions to arrive at agreement with external countries through a number of bodies including the Northwest Atlantic Fisheries Organisation, the North East Atlantic Fisheries Commission (NEAFC), the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), the International Baltic Sea Fishery Commission (IBSFC) and the North Atlantic Salmon Conservation Organisation (NASCO).

There are agreements with a number of Mediterranean and African countries and also with India, North Atlantic countries, and Argentina.

It has also been left to individual member states to apply and enforce the CFP within their own jurisdictions, but the principal of subsidiarity goes further in that so long as measures meet the requirements of the CFP it is up to member states to draw up their own regulations. This has been necessary for many artisanal fisheries and the cumulative importance of these smaller fisheries in income and employment terms should not be overlooked. This is an area of extensive fisheries regulation reserved to the individual member states.

Legislative framework

Following the declaration of the Icelandic exclusive fishing limit of 4 miles in 1952 and its extension to 200 miles in October 1975, 200 mile Exclusive Economic Zones (EEZs) were declared by several other European states (and the EC) in November 1976.

Within the EU, 200 mile EEZs were declared in Northern waters. However, due to political difficulties none of the Mediterranean countries declared a 200 mile EEZ. Much of the Mediterranean remains classified as high seas where any vessels, including those from third countries such as Japan, can fish beyond national (generally 12-mile) coastal zones.

States participating in the third United Nations Conference on the Law of the Sea (UNCLOS III) ending in May 1975 mainly accepted the principle that jurisdiction over the management of marine resources within EEZs lay with the coastal state concerned. Although declaring EEZs enabled coastal states to exercise jurisdiction over the management of many commercially important fish stocks, some stocks remained partially or fully outside national jurisdictions.
In order to address remaining questions of the management of EEZ/High Seas straddling and migratory stocks, an UNCLOS Convention on straddling stocks and highly migratory species was passed in 1982. Under article 63(2), this included an obligation for states fishing for such stocks to seek agreement on conservation measures.
Under UNCLOS states are obliged either to become members of regional fisheries organisations, or to abide by the conservation measures adopted by these organisations. Regional fisheries organisations of which the EU is a member include the North Atlantic Fisheries Organisation (NAFO), and the International Baltic Sea Fishery Commission (IBSFC).

Due to differences in interpretation, enforcement, reflagging and various other difficulties, the UN Conference on Environment and Development set out a general framework for management (Agenda 21) at its Rio meeting in June 1992. A further conference on straddling stocks and highly migratory species was then convened in order to reach agreement on remaining issues such as the compatibility of management measures inside and outside EEZs.

The institutional structure of fisheries management within the EU reflects the differences in jurisdiction. In Northern Waters fisheries management is coordinated through the Common Fisheries Policy (CFP).

In the Mediterranean fisheries management remains to a greater extent the responsibility of individual Member States, with TACs being set for only very few stocks. TACs are set for some of the major stocks fished in high seas areas of the Mediterranean, such as that for bluefin tuna set by the International Commission on for the Conservation of Atlantic Tunas (ICCAT).

The emphasis in the Mediterranean upon fisheries management within national coastal zones is largely explained by most stocks being concentrated within these zones. As a consequence of the inshore nature of most fisheries and in contrast to most Northern water fisheries, small-scale artisanal fisheries predominate, with over 70% of catches in the Mediterranean being taken by vessels below 16 GRT (European Parliament Undated).

Fisheries management is subject to other international agreements in addition to UNCLOS. Under Article 7 of the 1995 Food and Agricultural Organization (FAO) Code of Practice for Responsible Fisheries the long-term sustainable use of fisheries resources is stated to be the overriding objective of conservation and management (section 7.2.1). However, management measures are also to provide inter alia for maintaining economic viability, avoiding excess fishing capacity, recovery of depleted stocks, protecting endangered species and biodiversity, minimising pollution, waste, discards, and catch of non-target species (section 7.2.2).

Trends since 1979

The Treaty of Rome made provision for a Common Fisheries Policy and this was put into effect as decisions by the Council of Ministers established the principal of freedom of access to the Union's fisheries, introduced the concepts of a common organisation of the market in fish products, and created a Structural policy for the industry.

Since 1973 various derogations applicable until 2002 have been introduced designed to protect the interests of communities dependent on fishing. Essentially these derogations relate to coastal zones of 6 and 12 miles.

When the 200 mile Economic Exclusion Zone was established in concert with moves by other nations, the Commission entered into negotiations with third countries to secure or recover traditional fishing rights for Union Vessels. Eastern European vessels were excluded from European Union waters.

The principal of relative stability was adopted in 1980 to maintain quota shares among member states at the then existing levels. However, the Hague Preference agreement identified a number of areas dependent on fishing for income and employment and made provision to depart from the principal of relative stability in an agreed manner in order to protect their position. The areas specified were the island of Ireland, Scotland, the east coast of England from the border with Scotland to Bridlington, and Greenland.

In 1983 the Common Fisheries Policy established a system for the conservation and management of fishery resources and introduced a structural policy.

At first, neither the TAC levels nor the Structural Policy were imposed with any severity. Indeed, grants were available to assist vessel building and modernisation and remain so. Safety being an important consideration.

Gradually, the TACs have been tightened as have the Multi Annual Guidance Programmes of the Structural Policy.

As TACS proved unenforced or unenforceable and in the face of adverse publicity attracted by the practice of discarding, the Commission has turned to other means of controlling fishing to achieve the objective of stock conservation.

Technical measures have been widely used. They have included the Shetland Box, the Norway Pout Box and the Plaice Box. Also, there have been many attempts to reduce fishing mortality on young fish by requiring larger mesh sizes to be used. There was a moratorium on herring fishing in the North Sea from 1977-1983.

The medium term review of the CFP recognised a variety of problems of enforcement and effectiveness with the existing regime.

Ultimately, the Commission appears to have come to the conclusion that physical controls on fishing such as limiting days at sea are more likely to be effective. The MAGPs of the structural policy now appear likely to be used to limit absolute capacity to the maximum that will be consistent with stock conservation under the precautionary principle.

The medium term review led to decisions being taken which permitted the introduction of multi-annual and multi-species TACs, and express the hope that subsidiarity will lead to responsibility for fisheries management being given in part to fishermen's organisations. It introduced a system of licencing for all vessels throughout the European Union to facilitate reductions in excess capacity, and assist monitoring of activity. In recognising the success of the Shetland Box, it also provided for the establishment of further areas where access could be enhanced for local fishermen for socioeconomic reasons.

Thus the trend since 1979 has been towards ever tighter measures which impose inefficiencies on fleets as a means of trying to reduce fishing mortality. Further attention is being given to granting privileges to fishermen over their own localities. The notion of bringing fishermen into the management process is gaining support. The structural policy is moving towards a position where capacity is intended strictly to be brought into line with fishing opportunities rather than merely to reduce capacity.

Institutional and Legal Structure

Co-management and Subsidiarity

Due to the over-riding role of the central EU institutions, the CFP can be characterised as representing in essence a centralised system of management. Nonetheless, especially in areas falling within the remit of individual Member States such as formulation of detailed rules for management of national quotas, considerable scope exists for devolved decision-making and co-management.

In particular, the subsidiarity principle as it applies to the CFP implies that fisheries management decisions be devolved to the lowest level of government practically possible, thereby allowing flexibility in taking localised factors into account. The subsidiarity principle thus helps to explain the great diversity of fisheries management institutional structures within EU countries.

Established on the initiative of fishing vessel owners, Producer Organisations (POs) have been set up since the 1970s as marketing organisations to improve selling conditions by operating a system of withdrawal prices. However, in some EU countries POs have become involved in other areas of fisheries management.

In the UK POs have increasingly become responsible for quota management through a system of sectoral quotas. Following an initial trial in 1984 of haddock quotas to the Shetland PO, the sectoral quota allocation system was extended to cover other POs and quotas. Other ICES area IV and VI stocks were next to be allocated, followed by Irish Sea quotas in 1990 and quotas for the rest of area VII in 1991 (Slaymaker *et al* 1992). Under this system POs decide how to allocate their total quotas between different types of vessel and often stabilise members' fishing opportunities by allocating fixed monthly or weekly quotas. POs are also empowered to swap quotas between themselves.

Although POs have been set up in Spain in recent years, it is the *Cofradias de Pescadores* (fishing guilds dating back to the eleventh century) which are by far the most powerful local institutions. The *Cofradias* control the entire production of all species in a given region, determining exploitation patterns and production techniques, as well as managing the markets where the fish is sold (Franquesa and Lostado 1994).

Monitoring and Enforcement

Following the principal of subsidiarity, monitoring and enforcement of the Common Fisheries Policy is the remit of individual Member States, with the role of the European Commission restricted mainly to watching over the watchdogs (European Parliament 1994). The Commission retains the power to undertake spot checks at sea and in port of member states' monitoring. Where irregularities are suspected, the Commission can demand administrative inquiries and information on the application of EU regulations. Since 1988, the Commission has also had the power to undertake checks at sea in Northwest Atlantic Fisheries Organisation (NAFO) waters.

Each Member State's inspectorate is responsible for monitoring and enforcement in its own ports and maritime waters. Member States are required to be impartial and take legal or administrative action against the skipper of any vessel found to be violating management measures irrespective of the particular nationality of the vessel concerned. Prior to the introduction of 200 mile limits in January 1977, member states applied national regulations to all vessels within their 3 to 12-mile fishing zones, and to their own vessels beyond the 12-mile limit. Fleet sizes and the level of resources devoted to monitoring and enforcement vary considerably between Member States, implying that management effectiveness varies across the EU (Holden 1994).

Skippers of EU vessels over 10 metres in length are required to complete a log book recording the amounts of different species retained on board during the trip by area of capture. Each month Member States are required to provide the Commission with a detailed record of the quantity of fish landed at their ports, together with information on any trans-shipments. The total landings into all EU ports by

vessels registered in a given member state are then deducted from the corresponding remaining quotas available.

In order to ensure that TACs are not exceeded, member states are required to ensure that fishing is halted as soon as the corresponding quota is deemed to have been caught on the basis of expected catch rates. Through the management committee procedure, a mechanism is operated by the Commission for compensating fishermen who have been unable to take their quota owing to overfishing by fishermen of another Member State.

Part of the financial costs incurred by member states' in monitoring compliance with fisheries regulations have been met from EU funds. For instance, 56 million ECUs were spent in 1978 on assisting Denmark and Ireland to acquire naval and aerial surveillance capabilities (European Parliament *op cit*). As traditional methods of monitoring at sea are considered labourious, costly and relatively ineffective, the feasibility of high technology surveillance (e.g. using satellites) is actively being investigated.

National Measures and EU Economic Integration

After 1979, the power to adopt conservation measures passed from individual member states to the European Union. Member states retained powers to introduce limited measures so long as they are non-discriminatory, treating all Union fishermen the same, and were necessary for conservation purposes.

Treaty obligations including that under Article 7 of the Treaty of Rome of 1957 provide for a commitment to avoid "any discrimination on grounds of nationality". However, in order to maintain the preferential treatment of particular groups of fishermen under the Common Fisheries Policy, certain derogations were negotiated for a limited duration. For example, the 1973 Treaty of Accession of the UK, Ireland and Denmark established 10 year derogations from the principle of free access to other Member States' waters, stipulating the conditions under which coastal zones could be extended from 6 to 12 miles. Article 6 of Regulation (EEC) No. 170/83 provided for an extension from 6 to 12 mile limits for a further 20 year period. The Hague Resolutions of May 1980 established the principal of relative stability which fixed individual Member States quota shares, subject to certain preferences (Hague Preference) to specific areas highly dependent upon fisheries.

Access arrangements and related allocation issues continue to generate heated debate. A closely related question to national access arrangements is that of quota-hopping by flag ships - vessels acquiring fishing opportunities under the auspices of another Member State. In allocating national quotas member states can stipulate that in order to be eligible vessels have to be registered in the country and have a particular type of licence.

While the CFP currently provides for the division of fishing opportunities between different Member States, vessel operators from one Member State cannot be prevented from establishing themselves in any other Member States providing they have a genuine economic link with the country concerned (European Commission *op cit*). As long as the requisite national registration and licensing requirements are met, vessel operators may not be discriminated against simply on the basis of nationality.

There is currently considerable speculation regarding the form of the CFP will take after December 2002. Due to the different interests involved, each Member State would undoubtedly like to improve the access of its own national fleets to EU fishing opportunities. For certain Member States this could

be partly achieved by removing existing relative stability provisions and allowing free access of all EU vessels to all EU waters. For other Member States improved access of national fleets could partly be achieved by strengthening national provisions (e.g. removing flagships from national registers). Thus, despite the tendency within the EU towards greater economic integration, within the current framework of the CFP, moves towards economic integration will continue to be firmly resisted by certain Member States.

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IV EVALUATING INDIVIDUAL MEASURES: EU FISHERIES

Output Controls

TACs and Quotas

The TAC and Quota system has been widely criticised. It is not popular with the industry and there have been serious enforcement difficulties. Perhaps the most telling criticism that has been made is that these measures have failed to halt the decline in the spawning stocks, their prime purpose. While this is true, the extent to which they have succeeded, if at all, in reducing the pressure on spawning stocks remains a matter of conjecture.

Whatever the extent of the failure, there is no doubt that the measures have required the discarding of sometimes large quantities of otherwise marketable fish caught as part of mixed fishing activities when there has been a mismatch between the relative abundance of stocks and vessel quotas. Discarding plainly frustrates the objective of stock conservation and has been the source of much adverse publicity for the CFP.

The measures have been widely evaded. This has led to friction between Member State governments, and between their fishermen. The question in evaluating the measures, however, is not only whether the measures have been enforced but whether they can be enforced.

In Holland, failure to enforce the quotas under the ITQ system caused serious political problems. In order to control the activity of the Dutch beam trawl fleet, whose target species fall within the ITQ system, limits have been imposed on the number of days that may be spent at sea. These are related to the amount of time they are expected to need to catch their ITQs.

In the United Kingdom where enforcement is relatively tight, there is considerable anecdotal evidence that the quotas are evaded by both illegal, unrecorded landings, and by misreported landings, where fish are entered as another species in logbooks.

There have been allegations that the Danish industrial fleet in catching its sprat quota also takes excessive amounts of herring, and in taking its herring quota takes large quantities of juvenile cod and haddock. Because of the use to which the catch is put the fish does not have to be handled carefully and it is virtually impossible to determine the components of the catch when an industrial fishing vessel returns to port.

Spain, too, has faced problems in enforcing quotas. There appears to be a difficulty in that enforcement is agreed at the Council of Ministers by the central government but has to be carried out by the regional governments who were not party to the agreements.

Criticism of the system also relates to the detail. The quota year, a calendar year, does not always match the fishing season. This is especially so for some pelagic species. For herring and mackerel, for example, the season is from early to mid summer until early spring.

This means that stock assessments are also out of step with the quota year. An unfortunate effect of this was experienced this year when the TAC for North Sea herring was substantially reduced after the start of the season, following scientists' reconsideration of stock levels.

Such moves not only hit the income from the species involved, in the short-run, but also create difficulties in business planning for fishing enterprises which may find their investment has been misdirected through no fault of their own.

Another significant criticism has been that the TACs and quotas do not relate sufficiently to the relative stock abundances in mixed fisheries. This can be general or very localised depending on the behaviour of the fish but the effect is that while some quota remains those fish whose quota has been exhausted have to be discarded. This problem applies also to by-catches.

Clearly, the CFP TAC and quota system has not generally been effectively enforced. However, some discussion of its other effects may still offer insights of value in considering alternatives to the present management regime.

Undoubtedly, the impact of the economic incentive, created by the TAC system, to break quotas, has been to encourage the criminalisation of fishermen. This is aggravated by overcapacity, which makes many fishing enterprises of marginal profitability. A legacy of this will be a greater willingness to disregard other measures in the future.

As the TAC and quotas system has failed to constrain fishing it appears to have had little impact on fishing dependent communities. With some species experiencing single cuts in TACs of 20% to 50%, the impact would depend on the response of the price for the species to falls in supply and to the availability of other fishing opportunities.

A reduction in landings will in principle cause an increase in the price fetched so long as the local market is a significant part of the whole. How much this would offset the fall in supplies and maintain sales revenue from landings depends on the species and market concerned. The price fetched depends partly on the availability of supplies from other sources. The more supplies are available from elsewhere the less the price might be expected to respond to compensate for the shortfall in landings.

A further indication of the failure of the CFP TAC and quota system is in the age structure of the stocks and this impacts on the stability of a fishery. One of the indications of overfishing is that the age structure of a stock becomes biased towards the youngest year-classes. This makes the fishing possibilities variable according to the variability of recruitment of young fish to the fishery. The more dependent a fishery is on the younger year classes the less stable will be landings.

Also, in general in Northern European countries, larger fish fetch more per tonne than smaller fish of the same species - usually because they are less labour intensive to process. Were the scientists desires of larger spawning stocks and a better age structure to the stocks to materialise, income from a species would be more stable and better returns would be available from a greater average size of fish being landed.

The necessity of conserving stocks could conflict in the short term with the desire to ensure continuity of supplies of fish to the consumer at reasonable prices. However, it would be fair to claim that on the whole the objective of ensuring reasonable prices to the consumer has continued to be achieved, even if supplies have been variable.

Resistance to higher prices has meant that consumers may switch to other species or other sources of protein dampening any willingness by retailers to raise prices unacceptably high (Ioannidis and Matthews 1995). This may induce imports to the Union when domestic supplies are short.

The Hague Preference arrangements have served slightly to reduce the economic incentive to break quotas in communities heavily dependent on fishing.

The question is whether the CFP TAC and quota system has failed because of a lack of enforcement or because it is unenforceable. Denmark, Ireland, Holland and the United Kingdom have all made determined attempts to enforce the regime but nowhere has there been a success using these measures by themselves.

Both Denmark and Holland have adopted days at sea limitation as a means of bringing fishing activity into line with the available quotas. Once this is done the system effectively switches from one of output controls to one of input controls and the TACs are demoted in practice to objectives of the input control system. This does not overcome the problem of differences of stock abundance in multispecies fisheries.

The cause of the failure of the CFP TAC and quotas system is that, except in Holland, there has been no attempt to overcome the market failure.

It has left the race to fish still present and financial returns to the industry in the short-run higher than they would be if it had to take account of the social cost of its actions. In theory, a TAC system will work when the quotas are owned by enterprises and are transferable among them. Currently, excepting in Holland, quotas are not owned or transferable but are allocated free.

The Dutch practice shows that the current CFP is capable of offering a system of fisheries management which economists would argue will be effective and economically efficient. The Dutch ITQ system allows transferability of quota and should therefore be an example to others. However, the Dutch system has been beset with difficulties culminating in the introduction of physical restraint on activity.

The system has needed the support of effort limitation because constraints imposed on the market, by limiting its workability, have frustrated the attempt to overcome the market failure.

The reasons for the less than perfect behaviour of the Dutch system relate both to the institutional environment and the institution itself. The Dutch ITQ system could not alone contribute to the conservation of stocks because of the free rider problem.

It is a law of fisheries management that unless all nations sharing a stock effectively manage their quotas no conservation benefits can accrue to any participant. Since other nations were not pursuing an effective strategy the Dutch system could not serve to conserve stocks.

Leaving this aside, the question then arises as to whether the Dutch system worked, given the fishing opportunities left to it. Over-quota landings continued after the development of the scheme in the late 1970s and early 1980s. Initially individual quotas intended to be non-transferable were awarded to vessels but they soon became transferable with the vessel.

The purpose of awarding ITQs is to create a market in the resource where previously the market had failed. Because the Dutch system came about as a means of circumventing the non-transferability, two constraints which appear to have all but frustrated the operation of a pure market developed. Since only those with a vessel in the fishery could hold quota demand was limited. Secondly, when selling quota a holder could only to sell the whole of their quota. The quota was not divisible. Lack of enforcement was a further factor which prevented the system from working. These

all served to thwart the possibility of correcting over-catching by buying quota retrospectively, or of adapting quota-holdings to fishing opportunities. This has made the marginal cost of quota extremely high. Initially this reinforced the economic incentive to exceed the quota, until the physical restraint of days-at-sea allocations obviated the strict need for quota.

Thus the Dutch system did not work satisfactorily for two reasons - the free rider problem meant that alone it never could lead to stock conservation, and the intended market was initially so limited by constraints imposed that it could not operate fully. It is too early to say whether recent changes will allow the system to operate more effectively. The imposition of
days-at-sea limits is potentially a more cost effective method of ensuring compliance at least in the short run.

The high price of quota suggests that enforcement is working but also that first generation vessel owners do not take into account capital costs. In other words, the capital is treated as sunken, having been largely written off in the financial accounts (Davidse *op cit*). Those who were allocated quota enjoyed a very substantial windfall. The effect on the second generation of owner is to put them at a competitive disadvantage. For example, heirs who fish and inherit quota face the need to borrow to buy out those heirs who do not fish (Harmsma and Davidse *op cit*).

There has been an increase in the concentration of ownership of quota since enforcement was tightened in 1988. Over the period 1988 to 1994 companies with more than one vessel increased their ownership of the sole and plaice quotas from 40% to 60% (Davidse *op cit*).

Input Controls

A wide variety of measures is used within the EU in an attempt to constrain fishing inputs.

Administrative measures include restrictions on which vessels are allowed to participate and on various technical characteristics of the vessels (licencing).

A range of structural measures aims to limit aggregate fishing inputs at fleet level by regulating various technical characteristics, considered important determinants of fleet capacity, in aggregate.

Effort measures regulate the amount of time individual vessels and fleets as a whole spend at sea or fishing.

In theory, on grounds of efficiency, economic incentives are superior to administrative measures, and have the potential to reduce fisheries management costs and contribute to public finances in the process. Due partly to political unpopularity, no explicit attempts have been made within the EU to use license fees, taxation, or other economic measures as input controls. However, contrary to the rationale of input control, grants and subsidies have been made available for vessel construction and modernisation programmes as well as in support of other fleet structure measures.

Advantages, disadvantages, scientific aspects and socioeconomic problems associated with use of each of these types of input control within the EU are reviewed separately below. Conclusions of the somewhat sparse empirical studies available are drawn upon.

Licencing and Restricted Entry

Administratively, one of the simplest types of input control is a licencing system which constrains the number of vessels which are allowed to participate in a fishery. By 1994 licence restrictions to limit the number of fishing vessels had been introduced in all Member States.

Licencing provisions had already been introduced in Italy, the Netherlands, the UK and many other Member States. These have increasingly been used to not merely to limit the size of national fleets, but to restrict the number of vessel participating in particular fisheries.

For example, in the Netherlands a permit system was introduced in the cod fishery in 1981 and extended to other roundfish in 1987, although some vessels (mainly beam trawlers) continued to operate outside the permit system. In the UK separate pressure stock licences were issued in order to restrict the number of vessels fishing for quota species.

Regulation (EEC) No 1627/94 established general rules relating to the issue of and requirement for special fishing permits in order for vessels to participate in certain fisheries. Essentially the regulation is concerned to ensure that no discrimination on the basis of nationality takes place.

By itself licensing was never thought of as capable of producing any significant contribution to a reduction in fishing levels consistent with sustainable fishing. Instead, licensing was viewed as necessary as an initial measure to constrain further input growth.

However, due to input stuffing and input substitution, restricting the number of vessels fishing soon proved of little value even in preventing further input growth. Input growth can occur not only if there are increases in the number of vessels fishing, but also if the proficiency of vessels in catching fish increases, or if vessels spend more time fishing. The capacity of vessels to catch fish may increase if the average size of, or level of, inputs used by individual vessels increases due to technological progress, or for other reasons.

In order to constrain vessel capacity by restricting vessel operators' opportunities for input stuffing, licencing systems have increasingly incorporated restrictions on various technical characteristics of vessels. From the beginning of 1995 licences in all Member States have had to include information identifying the vessel and its operator, and give various technical characteristics (vessel and gear type, length, registered tonnage, power, fleet segment, etc). This data has to match that in the EU register of fishing vessels (European Union 1993).

While it is too early to judge the precise effects of the latest licence restrictions, the empirical studies currently available of licensing systems suggest that these measures result in input substitution thereby creating production inefficiencies (Pascoe and Robinson 1996). Thus, in the process of restricting inputs, licensing appears to have hindered the achievement of Treaty objectives of the rational development of fisheries production and optimal utilisation of factors of production.

The latest provisions will reduce vessel operators' scope for input substitution, but cannot be expected to eliminate it altogether. This means that while input constraints may be more effective in the short run than previous ones in preventing further increases in fishing, they can also be expected to create additional production inefficiencies. They are likely to hamper the achievement of rational development of fisheries production and optimal utilisation of factors of production.

A recent worldwide review of 43 cases in which licence restrictions had been used to manage fisheries (although only 4 of these were within the EU) concluded that:

"The evidence supports the hypothesis that limited entry encourages capital stuffing and/or fails to control the tendency for harvest costs to increase under TACs." (OECD 1996)

Licensing restrictions provide an administrative barrier to new entrants, thereby creating distortions in industry structure by hindering entry of potential entrants (e.g. younger fishermen).

On the other hand, licence allocation mechanisms can influence regional structure and further other socioeconomic aims of protecting areas highly dependent on fisheries.

By restricting participation in a fishery to those vessel operators holding the requisite licence, licensing systems implicitly create a property right which has a value to individual vessel operators related to the level of profitability in that fishery. For example, in 1994 licences in the Scottish pelagic fishery cost about 25% of the capital cost of a new vessel (OECD *op cit*).

In order to facilitate entry and exit from the sector, there are generally provisions to allow the transfer of licences from one vessel operator to another. However, even where the sale of licences is prohibited, licence values can be implicit in vessel selling prices, implying a significant financial barrier to new entrants if the number of licences is sufficiently restricted.

Structural Measures

The primary aim of EU Structural Policy is essentially one of long-run input control involving the creation of a EU fleet which matches available fishing opportunities, by altering fleet size and composition (Mastracchio 1992, Lassen *et al* 1996). However, it is only since the mid 1980s that EU Structural Policy has come to be aimed principally at restricting inputs rather than encouraging modernisation of the fleet.

During the 1970s structural policy actively encouraged the building of vessels in order to increase catches and thereby reduce the Community's deficit in fish supplies (Holden 1994). Although at the time of the introduction of the 1983-86
Multi-annual Guidance Programme (MAGP) scope for expansion was recognised to be limited, provision continued for fleet modernisation. Funding was made available to Member States through the European Agricultural Guarantee and Guidance Fund (FEOGA) for vessel construction and modernisation. This contributed to an estimated 64% increase in gross registered tonnage of the Community fleet in the period 1970-1983, and a further 24% increase in the period 1983-1987 (Holden *op cit*).

Although the 1987-91 MAGP set targets of a 3% reduction in aggregate tonnage and 2% in aggregate engine power of Member States' fleets by the end of 1991, provisions continued to be included for fleet modernisation. Only five Member States (Denmark, Germany, Spain, Italy and Portugal) met both their targets, and this was apparently in part only achieved by weeding out inactive vessels from national registers. Thus, the European Commission described EU Structural Policy during the period
1983-1990 as being characterised by "..the absence of any real control over fishing capacity.." (European Commission 1991). Indeed, failure to constrain fishing inputs was recognised as having resulted in fishing capacity generally increasing.

A group of biologists asked to advise the Commission on how "fishing capacity in balance with resources" should be interpreted, reported in 1990 that a reduction of at least 40% in fishing mortality rates was required on average. In making this judgement the group used the benchmark of long-run Maximum Sustainable Yield (MSY) (Gulland *et al* 1990).

Transitional MAGPs were introduced for 1992 providing for a further 2% reduction in both aggregate tonnage and aggregate engine power of Member States' fleets by the end of 1992. After protracted negotiations new targets were agreed for the 1993-96 MAGP stipulating a 20% reduction in capacity utilisation (fishing effort) in demersal roundfish fisheries, a 15% reduction in effort in demersal flatfish fisheries, and no increase in effort in pelagic fisheries. This represented a subtle shift away from capacity limitation to effort limitation and effort reductions were to be met by mainly (at least 55%) by reductions in capacity, but could be partly met by reductions in fleet activity (up to 45%).

The group of biologists asked to advise the Commission on the fourth generation of MAGPs and to comment on relationships between fishing effort and fishing mortality reported in March 1996. Concluding that most EU fisheries overexploit at least some stocks, they assumed that fishing mortality was directly proportionate to fishing effort and recommended large reductions in fishing mortality for many stocks (Lassen *et al op cit*)

It is almost universally agreed that most EU fisheries are characterised as having too many boats chasing too few fish. However, there is no consensus on how many vessels and of what type there should be in any given fishery. This is viewed both as a global problem and as an allocational one.

While fleet overcapacity is viewed by the Commission as one of the main obstacles to the rational evolution of the Common Fisheries Policy, questions of how fleet capacity and overcapacity can be best defined and measured remain fraught with difficulty.

Fleet capacity has generally been measured in terms of various technical parameters of vessels and gear used (number, size, power, etc). For instance, Lassen *et al* (*op cit*) treats vessel capacity and gear capacity separately, identifying factors considered relevant in determining capacity where different gear types are used (fixed gear, demersal trawlers, pelagic trawlers, and purse seiners). Vessel capacity is defined in terms of the number and size/power of vessels, and gear capacity to various gear characteristics (e.g. footrope length / beam length in demersal trawl fisheries, seine area for purse seine fisheries), as well as gear and catch handling equipment, and search equipment. In one respect Lassen appears to mark a change in emphasis, as it is notable that in the Chairman's Summary capacity is explicitly stated to be a constraint, even if it continues in effect treated as one of the principal determinants of effort.

However, as with licensing, the experience of structural measures has also demonstrated that regulations which restrict particular technical characteristics provide an incentive for vessel operators to substitute investment into unrestricted inputs. To the extent that structural measures succeed in constraining capacity at individual vessel level, this mitigates against the achievement of other aims of EU Structural Policy, namely ensuring optimal utilization of factors of production. Furthermore, constraining technical parameters of vessels tends to hinder the aim of increasing the productivity of vessels by technical progress.

In order to improve the consistency of fleet data between Member States, following Regulation (EEC) No 2930/86 Regulation (EEC) No 163/89 provided for setting up a Community register of fishing vessels and standardisation of rules used to define vessel characteristics. However, the Court of

Auditors noted that almost identical vessels built at the same shipyard can be registered in different Member States with 60% difference in tonnage (Court of Auditors 1993).

Thus, Karagiannakos (1995) concludes that the information contained in MAGP comparison tables "remains only indicative of how the tonnage capacity has changed in the Community and contributes little to the knowledge of the true and absolute fishing capacity."

Rather than as an input control, the allocational aspects of structural measures appear in some cases to have been the most significant. For instance, Frost *et al* (1995) analysed the impacts of decommissioning schemes in Denmark during the period 1987-93, costing 113m ECU, and in the Netherlands during 1987-94, costing 127m ECU.

While they report that Danish fleet capacity measured in GRT/GT fell by 29% and Dutch fleet capacity measured in engine power fell by 22%, they conclude that these had no effect on the total number of fishing days, or on fishing mortality. However, the decommissioning had marked effects on economic returns of vessels staying in the fisheries. Those vessels increased the number of days they fished. Dutch owners and crews staying in the fisheries are estimated to have gained an additional 90m guilders a year in total in additional profits and crew shares.

Similarly, during 1984-86, 225 UK vessels were decommissioned, with grants of £400 per gross tonne being made on the surrender of the vessel's licence, although owners were free to sell their vessel outside the EEC, or for non-fishing purposes within the EEC. Evaluation of this programme by the National Audit Office (1988) concluded that "the introduction of grants seemed to have achieved only an acceleration of a steady and
long-established trend of decommissioning" by the vessel owners themselves as a result of changes in fishing opportunities.

Effort Controls

It has become increasingly clear that simply using licensing and structural measures to constrain fleet capacity is ineffective in restricting fishing inputs unless fleet activity (time spent at sea, or fishing) is also restricted. Even if vessels remain unaltered in terms of physical and technical characteristics affecting their effectiveness at catching fish, effort exerted can increase significantly simply by individual vessels spending more time at sea.

Effort controls have come to be seen as necessary to supplement licensing and structural measures. For instance, Regulation (EEC) No 3760/92 provides for the introduction not only of measures to limit the number and type of vessels authorised to fish, but also time spent at sea. For the first time provision was made for total allowable fishing effort (TAFE) to be used either as an alternative or as compliment to TACs. The fishing effort of a vessel is defined in the Regulation as the product of its capacity and its activity, with fleet capacity defined as the sum of individual vessel capacities. Following the subsidiarity principle Member States were empowered to introduce conservation measures in their own waters providing they applied to stocks of interest only to their own fishermen, or applied only to their own fishermen.

It should be noted that concerns have been expressed about defining and utilising measures of fishing effort and aggregating from individual vessel to fleet level (Valatin 1992, Rodgers 1995, LEI-DLO *et al* 1996).

Various effort and activity restrictions have been introduced in several Member States. In Denmark limitations on days at sea were introduced in December 1993 on a trial basis for a year in Sole and Nephrops fisheries in the Kattegat, replacing existing quota restrictions. In the Netherlands and the UK Days at Sea limitations were introduced in order to reinforce other existing measures including licensing and quota systems, and to help solve compliance problems. In Italy, Days at Sea limitations were introduced in the clam fishery, together with daily catch quotas, authorised landing sites, and other measures.

In each case days at sea allocations were made to individual vessels. In Denmark allocations were based upon the average number of fishing days of participating vessels over the previous three year period (1990-1992). In the Dutch case where an ITQ system continued to operate, a more complicated system is used. The number of days allocated are calculated using regression analysis of past catch rates and vessel characteristics to estimate how much time vessels with given characteristics could be expected to require in order to take their quota. Under various effort controls introduced in the UK in 1990-92 (92-day and 135-day rules, and 8-day tie ups) identical limits were set for all vessels affected. In the UK case vessel operators were also given the option of switching to using larger mesh gear instead. In Italy vessels were allowed to fish for clams 5 (later 4) days a week, with maximum 8-hour days.

Once a system of vessel registration is in place, restricting the number of days individual vessels spend at sea is relatively easy. Although days at sea tend to be less well correlated with catches than time spent fishing, ensuring compliance with limitations on fishing time or other elements of sea time is more difficult as it necessitates monitoring at sea. Ensuring compliance with effort controls is also more difficult where vessels participate in more than one fishery.

Where effort controls are effective in restricting vessel activity, simply as a consequence of preventing vessels spending as much time at sea as they would otherwise, effort controls necessarily reduce the economic returns of individual vessels.

As at the margin effort control can tip the balance from vessels making a profit to making a loss, some fishermen view such regulations with great suspicion as representing an attempt to achieve decommissioning without compensation.

As with licensing and structural measures, to the extent that effort controls are successful in constraining vessel activity, an incentive is provided for vessel operators to increase their own returns by focusing investment in unrestricted inputs. Like licensing and structural measures, effort controls therefore lead to production distortions which mitigate against achievement of the CFP objective of optimal utilization of factors of production.

Vessel Operator Taxes and Subsidies

Various forms of financial assistance made available to vessel owners in support of CFP structural policies such as construction, modernisation, laying-up, and decommissioning grants, have already been mentioned. In addition to these, a wide range of other types of subsidies and taxes indirectly affect fishing inputs by influencing vessel operators' costs and returns. Although often not intended to influence fishing inputs, these measures affect input control (usually by encouraging vessel operators to increase their fishing inputs).

Initiatives which subsidise improvements in harbour and on-shore ancillary facilities can reduce vessel operators' costs and by increasing profitability, provide an incentive for vessel operators to increase their fishing intensity.

Taxation and depreciation rules often provide more favourable treatment for reinvested profits compared to those declared as such and paid to owners. These provide incentives for individual vessel owners to increase the share of profits reinvested in their vessel or used for purchase of a new one (Jensen 1996). This promotes goals of fleet modernisation and technological efficiency, but in doing so increases the effectiveness of the fleet (capacity). In the absence of stringent restrictions on fleet activity, this generally results in increases in fishing intensity.

Technical Measures

There is an enormous range of technical measures that have been applied throughout the European Union. Some have been applied as part of a common set of technical measures applying to a fishery and others have been introduced as member states exercised their option under the CFP to apply measures to local fisheries. The principal measures are discussed here.

Many technical measures appear to have been enforced relatively effectively. Because of this there is a temptation to attempt to use technical measures more severely as a means of fishery management than pursuing their immediate objectives permits. For example, there is some trade-off between increasing mesh sizes, which makes it harder to catch fish, and lowering the amount of fishing. However, the effectiveness of technical measures is limited by the impact they may have in conserving stocks only to leave a more productive, more profitable, and therefore more attractive resource.

Gear Restrictions

Mesh Sizes

Minimum mesh size limits have been widely used. Their effectiveness in conserving young fish is not proven. Although there is no doubt that smaller fish are allowed to escape, the selectivity by size of fish is not perfect in seine and trawl gear causing some young fish to be retained in the net (Reeves *et al* 1992). The more fishing that occurs the higher will be the mortality of young fish. In order to take their quota fishermen need to set their gear more often if mesh sizes are increased defeating the purpose of the increase.

Other related measures that can be imposed are restrictions on the diameter of the cod-end and the length of the extension piece in trawl gear. Mesh sizes have gradually been increased, in the North Sea whitefish fishery for example, from a 70mm minimum to the present 100mm.

Square Mesh Panels

The purpose of these is to exploit the behaviour of the demersal species in swimming upwards to escape. Square mesh panels in the extension piece of a trawl net may allow better selectivity by size. The Commission has considered these but only in Sweden are they required. Grants are available for the panels for Swedish vessels from their government.

Ecosystem Conservation Measures

These include a variety of measures for conserving species other than fish. Examples are dolphin doors in gill nets to prevent dolphins from being trapped (applied in the tuna fishery in the Bay of Biscay), prohibition of gill nets to protect sea birds (in the North Sea) and of nets made of fine monofilament twine.

One-Net Rules

These rules are intended to ensure that the correct gear is used in a fishery. Some vessels switch target species, for example from roundfish to nephrops in the North Sea where a derogation exists permitting a considerably smaller mesh size, 70mm, to be used when otter trawling for nephrops.

By-Catch Rules

These exist in many Union fisheries mainly to protect species under pressure. They are especially difficult to enforce in industrial fisheries, and otherwise suffer the same problem of illegal landings and misreporting as the TAC and quota regime. By dint of their existence they exacerbate the discarding problem.

Minimum Landing Sizes

These seek both to protect young fish by making them unmarketable. In Northern Europe they also protect the markets from being overburdened with quantities of small fish of uneconomic size which cause a fall in the price obtained. There is little doubt that the measures have succeeded in preventing quantities of small fish from disturbing the markets. The processing sector has mixed requirements as regards size, however. Some processors prefer larger fish which are less labour intensive to process and for which there are filleting machines, while the retail and catering sectors generally prefer fish of plate size. Whether minimum landing sizes have succeeded in protecting young stocks is a matter of debate given the high levels of discarding reported. Again these measures cause some discarding, though it is not clear how much small fish would be retained on board if there were no minimum landing sizes.

Discarding Restrictions

None apply in the European Union.

Closed Areas and Closed Seasons

These have been tried in the European Union for two reasons. First, to conserve young fish, and secondly to protect the livelihood of fisheries-dependent areas.

There have been a number of notable examples of the first; the Norway Pout Box, the Mackerel Box, the Plaice Box, and the Hake Box. The Shetland Box and the Irish Box are examples of the second, as are the 6 and 12 mile coastal zones.

The Norway Pout Box introduced in 1977 prohibited industrial fishing for Norway Pout (which is not used for human consumption) in an area of the western North Sea stretching from southern Scotland to the Shetlands. Its purpose was to protect juvenile cod and haddock from being taken as a by-catch. Other fishing continued.

It was concluded that on balance the gains from the Norway Pout Box in terms of increased catches of haddock and whiting for the Scottish fleet outweighed the losses of the Scottish and Danish Industrial fleets. Prices for haddock and whiting in Scotland were lower but not sufficiently lower to wipe out gains from increased landings and the consumer benefitted from lower prices and increased availability of supplies (McKellar *et al* 1987). The study shows clearly the importance of redistributional effects when fisheries management measures are invoked.

The Mackerel Box was set up in 1980 to protect the juveniles off the south-west coast of England. It was enlarged in 1983 and closed in March 1984. The box was deemed to have caused a shift in fishing onto other stocks and to have had adverse effects on the processing sector and employment on-shore. However, the western mackerel stock appears to have redistributed itself northwards in the late 1980s and it is not possible to assess the box's effect.

The Plaice Box was instituted in 1989 in the eastern North Sea along the coasts of Denmark, Germany and Holland. Its purpose was to protect juvenile plaice and beam trawlers of 300kW and over were excluded from the area. The plaice TAC was increased and the stock was thought to be of healthy size. However, the recent sharp cut in the TAC suggests that the initial impact has worn off. This is typical of what may be expected from these measures if no allocation of a property right or an insufficient charge is instituted for access to the stocks.

The Shetland Box was included in the 1983 CFP agreement. It limited entry to the box by licences issued by national governments to a total of 128 (62 UK, 52 France, 12 Germany, and 2 Belgium). It has been less of a success than was expected and there have been calls for its area to be extended (Anon 1992). Its objective was limited in that it did not set out to conserve stocks *per se* but sought to retain whatever stocks were available for the local fishermen and those who had traditionally fished them.

A seasonal closure was introduced to protect juvenile Hake in an area off Spain and Portugal in 1992 and another for fishing for herring and sprat off the west coast of Jutland in 1983 which led to considerable unrest (Holden *op cit*). The former is too young to evaluate its conservation effects and any produced by the latter are obscured by the recent decline in herring stocks in the North Sea.

Boxes have an additional difficulty. It has been found that it is often difficult to ascribe a geographical boundary to stocks which are apt to move as environmental conditions change (European Commission 1995). This was found to be true of the Mackerel Box.

Moratoria

The most significant example of a moratorium was that imposed on fishing for North Sea herring from 1977-1983. It all but destroyed the market and distribution system, changing the product in Holland

from the valuable salted herring to frozen herring, an inferior product. It was a success for the stock levels but the recent 50% cut mid-season in the TAC indicates that the achievements were only temporary.

Moratoria may not necessarily destroy a market depending on the availability of supplies from elsewhere but they have significant distributional effects on-shore in employment and income which as the Dutch example has shown may never be reversed. Stock recovery may be possible though slower without the economic activity bearing undue damage. The most significant point is that the rewards in renewed stocks will again be dissipated unless the market failure is corrected.

Other Measures

There is a number of other technical conservation measures such as limiting the length of beam in beam trawl fisheries, reporting-in rules and banning twin rigging.

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V EVALUATING INDIVIDUAL MEASURES: REST OF WORLD FISHERIES

Output Controls

TACS and quotas

Traditional TAC and quota regimes have been tried in a large number of places around the world, and in a wide variety of circumstances. Nowhere have they been completely successful by themselves and most of the problems that have emerged in the CFP system are reflected elsewhere around the world.

Discarding is recognised generally as a problem arising from all quota systems. The impact on highgrading is less clear. Highgrading as it relates to quotas involves discarding saleable fish of a given species to make room for higher value fish of the same species. This can only take place if there is sufficient of the more valuable fish in the stock to satisfy the quota. Unless an allocated quota is transferable or a fee is charged for quota these systems do not tackle the market failure.

There are many variations of the TAC and non-transferable quota system such as community quotas but in essence they have similar characteristics. Where no charge is made for the fishing right, they suffer the problem that they provide an incentive to invest if they have any short-run success.

Individual Quotas

Norway provides an example of the individual quota system. Licences are needed to fish in all the major fisheries and a vessel receives an allocation of quota. As with other systems the licences and implicit right to quota have acquired a value. They can only be exchanged with a vessel and with government approval. A vessel with a licence and quota fetches a greater price than one without.

The system has not produced efficiency in minimum cost terms and so continues to allow some of the resource rent to go unexploited as a result of overcapacity. Trondsen and Angell (1992) suggest that the introduction of quotas provided an incentive to vessel owners to increase capacity.

The conservation impact is less clear. The Capelin stock over which Norway has shared jurisdiction with Russia and Iceland during its migration has collapsed twice despite the TAC regime with individual non-transferable vessel quotas. The second collapse is attributed to activity by sea mammals, cod, and herring and in 1995 a moratorium was again imposed (OECD 1996).

The system has amounted to allocating a right of access to fisheries through the restrictions on licences and quotas which have subsequently acquired a value in exchange, but the restrictions have been insufficient to produce a minimum-cost catching sector. Indeed the incentive has been in the other direction. In the Norwegian context, however, efficiency has been balanced against the continuing regional benefits of a widespread fishing industry.

Enterprise Allocations were introduced in Canada's offshore groundfish fishery in the 1980s but failed to prevent the collapse of stocks. However, this seems to have been partly due to fishing by other nations and the problem of jurisdiction over straddling stocks.

The distinction between transferable and non-transferable quotas has often become blurred as a result of the allocation of an apparent right to quota for the foreseeable future, and the possibility of transferring the right to quota with a vessel or its licence.

Individual Transferable Quotas

ITQs have been tried in a number of countries around the world, among them Australia, Canada, Iceland, New Zealand, and the United States.

Generally reports of the system are favourable. They point to a reduction of excess capacity promoting an efficient minimum cost activity. Compliance has generally improved, though it has taken a while for fishing enterprises to adapt to the notion of private ownership of the resource and change the attitude towards conserving it. In the Canadian sablefish, geoduck, and halibut fisheries, for example, the ITQ system eliminated the problem of catches exceeding TACs. Quality of product is said to improve because fishing can take place at a more relaxed rate (OECD 1996).

In both Iceland and New Zealand limitation of ownership on grounds of nationality has limited the price achieved by quota at sale.

In Iceland, where the system has been successful it took nearly a decade from implementation beginning in 1984 for the industry to recognise that the resource had become privately owned and to adapt its attitude towards conservation. In the meantime effort controls were offered as an alternative to limit the ability of enterprises acting in concert to exceed the TAC. This option was removed in 1991.

It is not clear whether the Icelandic system has led to increased or decreased discarding (Arnason 1995) but in New Zealand discarding as a result of by-catch is recognised to be a continuing problem (Clark 1992).

In most cases allocation of quota has been made without charge to those present in the fishery. Without a resource rental this has meant that the whole of the present value of future returns from the quota is capitalised in the quota price at first sale. This has made quota costly and some concern has been expressed that this leads to an unfair advantage for first generation quota holders over subsequent buyers, and also that the cost exerts excessive pressure on the viability of second generation fishing enterprises (Copes 1992).

TACs have been set too high in a number of cases. An effective ITQ regime requires good information on the state of the resource. In New Zealand the initial allocation of ITQ was made as an absolute tonnage of fish for each species. However, in the absence of adequate data on the condition and life history of Orange Roughy, the TAC appears to has been set too high. The stock declined sharply to a position which would have required large amounts of expenditure by the government to buy ITQ as a means of reducing the TAC. This produced a crisis in the system and quota allocations were converted to percentages of TAC thereby shifting the burden of risk from the government to the industry.

A further problem to emerge in the New Zealand system was that capacity was slow to adjust. The apparent reason is that the capital invested in the vessels while retaining a real productive capability is written off relatively quickly in the accounts. A decommissioning scheme would appear to be advantageous at the implementation of an ITQ regime if a speedier movement towards cost efficiency is required.

The New Zealand system initially attempted to extract some of the resource rent from the industry by charging a rental for ownership of quota (Robins 1988). This was resented by the industry as a tax, but had the benefit of reducing the marginal cost of quota and limiting the creation of unfair competition between the first and second generation owners of quota. The application of a resource rental was thwarted when it was held to be in conflict with Maori rights established under the Treaty of Waitangi.

The development of the ITQ system in Australia is very recent and it is too early to draw conclusions. Fisheries Management has been removed from the government and placed in the hands of an agency.

Countries where ITQs appear to have been successful in achieving an economically efficient fishery and conserving the stocks have a number of common characteristics. The fisheries usually fall within a single national jurisdiction creating a common system of enforcement within a fishery. There is normally a small number of ports into which vessels either can or are allowed to land their catch. Excepting New Zealand and lately Australia the number of species in the fisheries has been limited avoiding the problems that might occur with mixed fisheries.

It is clear that the system is dependent for its success on good scientific advice and monitoring of catches remains difficult. In New Zealand this has been overcome by placing observers on each vessel. Their salaries are paid for by the vessel. Clearly such a monitoring system requires a fishery of large vessels and the management costs are high. Further monitoring is effected by auditing the records of vessels and processors.

Quota Fee System

A system of quota fees can correct market failure by increasing individual vessel operators' harvesting costs to internalise the externality created by their fishing activity. Generally unpopular with vessel operators, such systems have seldom been implemented.

Following independence, a quota fee system was introduced in Namibia in the early 1990s. For each species fees are charged at a fixed rate per tonne of quota, irrespective of whether vessel operators catch their quota or not. Quotas are allocated to vessel operators having been granted exploitation rights. The level of quota allocated is a fixed percentage of the TAC and the quota is largely non-transferable, with only one trade per year allowed by the government, and only then in exceptional circumstances. According to various national and socioeconomic objectives, rebates are given to certain categories of vessel depending on factors such as the extent of Namibian ownership and employment.

On the whole the system seems to have worked exceptionally well so far. While TACs have been set at quite conservative levels, the contribution of fisheries to GDP has doubled since independence, with quota fees which account for around 15% of landings value being a nett contributor to government revenue (ie more than covering management costs). In general stocks appear healthy. Although pilchard stocks collapsed, this has been attributed to environmental factors rather than overfishing, but it is unclear whether the hake stock is yet recovering from
pre-independence over-exploitation.

Strict enforcement contributes to this apparent success. Compliance is facilitated by banning trans-shipment at sea, a system of on-board observers, monitoring of all landings at the country's ports, and by there being only 2 ports and about 120 companies involved.

Input Controls

Licencing and Restricted Entry

Partly due to administrative simplicity, licencing systems and restricted entry are also one of the most prevalent types of input control used in countries outside the EU. However, as within the EU, licencing has tended to prove ineffective in achieving fisheries management objectives.

In Australia the North West Territories Barramundi fishery managed by limited entry during the 1960s and 1970s failed to prevent effort increasing. Restricted entry introduced in the North Western Rock Lobster fishery in 1965, in the North West Slope trawl fishery in 1985, in the Southern Shark fishery in 1986, and in the Great Australian Bight trawl fishery in 1988, all reportedly failed to prevent effort increasing (OECD 1996).

Similarly, in Canada limited entry introduced in the Pacific Abalone fishery in 1977, the Atlantic inshore groundfish fishery in 1980, and the Pacific Sablefish fishery in 1981, reportedly failed to prevent effort increasing. In the USA limited entry introduced in the Atlantic wreckfish fishery in 1992 is reported to have resulted in overcapitalisation and increased fishing costs, and to have failed to prevent effort increasing (OECD 1996).

In Alaska limited entry was introduced in most of the salmon fisheries in 1974. The process was accompanied by lawsuits and protracted disputes over initial license allocations. Aided by enhancement programmes, catches have tended to rise and stocks are reported to be strong in most areas. As a consequence of licenses acquiring a value, limited entry is reported to have created inequalities in previously non-competitive egalitarian communities (OECD 1996).

Management of the Alaska herring fishery using limited entry permits and TACs led to season length being progressively shortened. In the Sitka sound herring fishery, the quota is taken in less than 24 hours.

In Norway limited entry was used (in conjunction with other measures) to manage the Capelin fishery from the 1970s. However, this failed to prevent stock collapses in 1986 and 1994 (OECD 1996).

The OECD(1996) report on economic aspects of fisheries management examined 38 cases in which licence restrictions had been used to manage fisheries, mainly outside the EU. Evidence of changes in effort accompanying licensing restrictions were mixed. But instead of assisting resource conservation at least temporarily, the report concluded that:

"The evidence is quite the contrary, showing that limited license management does not stem the tendency to overexploit the resource."

In the few cases where significant charges are made for licences there has been some success. In the Falkland Islands a system of license fees was introduced in 1987 in the Loligo squid fishery, after a period of open access. The level of fees are calculated on the basis of vessel Gross Registered Tonnage (GRT). The number of licenses allocated is based upon alterations in the level of total allowable fishing effort consistent with the estimated current biomass level and previous escapement rates. Licenses are allocated for a fishing season using a point system, with preference being given first to locally-owned vessels, and secondly to EU vessels, with those with longer histories of participation in the fisheries being favoured.

The Falklands license fee system contributes a considerable proportion of total government revenue, while so far succeeding in conserving fishery resources. The system depends upon on-board observers collecting biological, catch, effort, and position report data on a daily basis (des Clers 1996).

Structural Measures

Although in many instances structural measures have been used to actively encourage the building of vessels, it is those used to constrain fishing inputs which are examined here. As within the EU, such measures have generally failed to constrain fishing inputs, while often producing unintended distortions in the production environment.

In Australia following the introduction of restricted entry in the South East fishery in 1985, a vessel replacement regulation was introduced in 1986 to limit the scope for replacing existing vessels with larger more powerful ones. This failed to halt input growth due to technological advances and other factors. Licenses became valuable assets, with boat capacity units being tradeable. This increased capital costs to new entrants and provided an incentive for more intensive use of existing vessels (OECD 1996).

In the Canadian Atlantic inshore groundfish fishery vessel operators circumvented vessel length restrictions by building wider, deeper draught vessels. After hold capacity became restricted, capacity continued to increase due to improved gear and equipment (OECD 1996).

In Norway the Participation Act of 1972 included vessel replacement provisions to constrain vessel capacities. In combination with a quota system, these measures apparently proved unsuccessful, with the Norwegian Authorities reporting that:

"Experience has shown that input regulation is not enough to secure sustainable use of the resources." (OECD 1996b)

Effort Controls

A variety of effort and activity restrictions has been introduced worldwide, often supplementing other measures such as restricted entry.

In mobile gear fisheries effort control measures include limits on days at sea, days fishing, trips, and the minimum length of time between trips. In static gear fisheries effort control measures include limits on the number of units of fishing gear used during a fishing season. As within the EU, effort controls have tended to be largely unsuccessful, leading to production distortions due to increases in unrestricted inputs.

The OECD reports (1996a) that in Canada days at sea restrictions introduced in the Pacific Halibut fishery in 1979 reportedly failed to prevent effort increasing. Capacity is reported to have increased due to capital stuffing, with fishing days falling from 65 in 1980 to 6 in 1990.

In the USA trip frequency limits were introduced in the Pacific Ocean perch fishery in some areas in 1981. However, stocks failed to rebuild and remained low.

Restrictions on fishing hours introduced in the Atlantic surf clam fishery in 1977 reportedly failed to prevent effort increasing, with reductions in allowable fishing time being made due to continuous increases in fishing power. By 1990 vessels were permitted to fish for only six hours every other week.

Effort controls in the Atlantic surf clam fishery were replaced by an ITQ system in October 1990. Industry operated effort controls, crew size and trip length regulations operating in the Atlantic surf clam fishery prior to 1982 failed to prevent effort increasing. Numbers of vessels declined in the early 1980s although crew sizes increased, with vessel numbers increasing in the late 1980s, and total days fished steadily increasing over the period.

In Australia the total number traps used in the Western Rock Lobster fishery were limited to 76623 units in 1965, supplementing other existing measures (restricted entry, closed season, etc). However, this effort limitation reportedly failed to constrain effort due to improvements in gear, methods, and technology, and more intensive fishing.

In Iceland effort controls were introduced in the groundfish fisheries in 1985 as an alternative option to ITQs. These are reported to have provided an incentive for capital investment and to have failed to prevent effort increasing. The effort limitation option was withdrawn in 1991.

The OECD(1996)report on economic aspects of fisheries management examined 22 cases in which individual effort quotas had been used to manage fisheries, mainly outside the EU. Finding some evidence of capital stuffing, increased harvesting costs and increased enforcement problems, the report concluded that individual effort quotas do not effectively prevent overexploitation.

Vessel Operator Taxes and Subsidies

Financial support is given in many countries to the fishing industry in order to ensure fishermen's well-being and vessel operators' profitability. Although in the short term such measures may increase fishing incomes and ameliorate the impact of reduced fishing opportunities, in the longer-term they can be self-defeating, providing incentives for increasing fishing inputs and encouraging overcapacity.

For instance, state aid excluding construction and decommissioning grants given by the Norwegian government averaged 1.3 billion Krone a year (constant prices) during the period 1964 to 1992, and resulted in overcapacity. Levels of financial support have recently been reduced, falling from 1.2 billion Krone in 1990 to 120 million Krone in 1995, with minimum wage guarantees and transport subsidies being the main schemes remaining (OECD 1996b).

A wide range of other subsidies and taxes also indirectly affect fishing inputs by influencing vessel operators' costs and returns. Often unintentionally, these measures can affect input control, providing incentives to vessel operators to increase their fishing inputs.

Fishing fleet costs and earnings data is generally sparse. However, according to FAO(1993) annual operating costs of the world's fishing fleets were US$ 92200 million in 1989, compared to total value of the catch of US$ 69700 million, implying that a loss of some US$ 22500 million before allowing for capital costs.

Technical Measures

As within the EU, an enormous range of technical conservation measures have been applied in other countries. The principal measures are considered below.

Technical measures generally make little contribution to stock conservation by themselves. By reducing vessels' effectiveness at catching fish, they create inefficiencies which increase unit costs and reduce fishing profitability. To the limited extent that technical measures contribute to stock conservation objectives, they create a more profitable resource, thereby increasing incentives to increase fishing intensity, and for input stuffing where entry restrictions exist.

By-Catch Rules

These exist in many fisheries. By-catch rules are especially difficult to enforce in industrial fisheries where the fish landed compose of a largely unidentifiable morass. They generally suffer the same problem of illegal landings and misreporting as the TAC and quota regime, while exacerbating the discard problem.

Restrictions on mesh size, size and sex of fish caught or landed

OECD(1996) provides an evaluation of evidence from 50 fisheries worldwide where size and sex selectivity restrictions have been used, including minimum mesh size, minimum landing size and restrictions on retaining egg-bearing female crabs and lobsters. Finding evidence of increased discarding in a few cases, and that stock sizes increased in 10 cases and decreased in 18, the OECD(1996, p108) study concludes that:

"The available evidence does not support the hypothesis of increased stock size."

Discarding Restrictions

A discard ban has been imposed in Norway, but in the absence of on-board monitoring, its effectiveness in eliminating
high-grading is impossible to judge.

Other measures

There are an number of other technical conservation measures such as limiting the length of net in tuna drift net fisheries.

Closed Seasons and Areas

The reaction of fishing enterprises to closed seasons, especially where there are no TACs, is to invest in more power and technology to enable their vessels to catch as much as possible in the time available. This capital stuffing is a well recognised problem, but it cannot take place instantly. There will be a lag

between the introduction of regulations and the surge in fishing power that will result. This gives a breathing space during which the measure will be effective, but as time progresses a reduction in the length of the season will be necessary.

Two cases from the Pacific serve as examples. In 1923 a closed season of 3 months was introduced to protect the Pacific Halibut in what had been an all year round fishery. By 1928 it had become clear that the closed season alone was insufficient to protect the species. In 1972 the Area 2 fisheries for Pacific Halibut off British Columbia had become restricted to an open season of 101 days International Pacific Halibut Commission 1973). By 1989 Area 2A was open for just three 24-hour periods (International Pacific Halibut Commission 1989). The remainder of Area 2 showed virtually the same decline.

The experience of the Sablefish fishery is similar, with the all year round fishery in 1984 experiencing a shortening season until in 1992 it had been reduced to about 150 days North Pacific Fishery Management Council (1993).

It is possible to conclude that closed areas and closed seasons will have some short run success. Perhaps their only real virtue might be that they provide a short period of effective restraint when other measures can be put in place.

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VI ALTERNATIVES TO THE EXISTING TACS AND QUOTA SYSTEM

Introduction

Three requirements of the management of fisheries can be identified which will serve to improve the returns to society from fishing and conserve the stock:

economic efficiency,
effective enforcement of regulations,
accurate stock assessment.

The remaining Sections of this report deal with the first two. The third is outside the scope of this report except where it impinges on the first two.

These requirements dictate five characteristics of any proposed system. If the system is to succeed it must:

correct the free rider problem,
correct the market failure problem,
be politically acceptable,
be administratively feasible,
be compatible with the existing European Treaties.

It is not possible or appropriate in a report of this nature to specify exact systems and complete sets of rules to implement them. What we have tried to do is to set out the basic needs of several systems that could be imposed with some effect in certain types of fishery to replace the existing failed management regime. The advantages and disadvantages of the alternative systems, and lessons from the experience of others are also discussed.

However, one common strand emerges. In all cases we recommend a relatively slow transition to the full operation of a new system. The reason for this is to allow adequate time for economic and particularly socioeconomic readjustment. In most cases a twenty year time frame is envisaged. This is an appropriate time scale in which to allow the distortions imposed by the present fisheries management regime to be shaken out and for the process of stock and spawning stock recovery to be completed where this is necessary. Only in the cases of North Sea cod, plaice, and herring is it clear such a deliberate and careful time scale would involve any risk to the stocks and only a minor risk in the case of the two demersal species. Fortunately, the North Sea herring stock is, in any case, more amenable to remedial action if needed.

Some of the most publicised fisheries problems in recent years have arisen as a result of conflicts between fishing vessels engaged in different types of fishing activity on the same ground. We also suggest a way in which such conflicts can be prevented.

Ownership of the Resource

Ownership of the fish resource or possession of harvesting rights is considered by many to be at the heart of the free rider and market failure problems which lead to overfishing, economic inefficiency and wasting of the potential benefits to be derived from fisheries. However, private ownership is not a necessary condition for making the industry bear the full economic cost of fishing (including the cost of the externality) that otherwise leads to market failure. Though there are undoubted economic incentives associated with private ownership which encourage efficient use of the resource, other means of internalising the costs of the externality exist such as charging a royalty on landings.

Essentially ownership of resources may be at the European Union, Member State, local community, or private level.

At present, throughout the Union ownership of the resource is *de facto* largely in the hands of Member States, though in theory it may reside under the Treaty of Rome in the European Union. The Netherlands is a notable exception where holders of ITQs in the beam trawl fishery have private ownership. The only other exceptions in the European Union are in small sedentary inshore shellfish fisheries where private ownership relates to an area of seabed and the stock on it.

Ownership of the right to exploit the resources, however, has generally been conceded to those who historically have used the right to fish though the precise extent of the legal rights granted is generally unclear. Thus, for example, it is not certain whether ownership of a licence is in perpetuity (even if issued annually) or whether licences can be withdrawn other than as a penalty for irregularities.

Ownership of the resource is not necessarily a problem, but is something of which the appropriate authorities must be aware in instituting any given fisheries management system. Those which offer rights in perpetuity will almost certainly lead to many more legal and administrative problems if the system fails and has to be replaced. On the other hand, rights-based systems may be severely handicapped by time limitations placed on rights or ownership.

Ownership can thus be separated into two classes - public and private. The responsibility for ensuring effective fisheries management remains inescapably in the hands of governments, even if they delegate the functions, because they are the only organisations which can claim to represent society.

Management structure

Fisheries management comprises several interdependent components encompassing not purely a system of rules, but also methods of decision-making, administration and enforcement. The management structure is an important influence on the extent of success of fisheries management systems.

Co-management, subsidiarity and the acceptability of change

A management structure is most likely to facilitate successful fisheries management if it involves vessel operators. In order to do this several characteristics are important. These include the degree of simplicity of management structure and transparency of the scientific assessments and decision-making process, perceptions of equitableness and the extent of compliance by other vessel operators.

In order to increase the extent of co-management, new bodies could be created, or the role of existing industry organisations such as POs could be upgraded so that they play a greater part in fisheries management.

Greater openness and transparency in the provision of scientific advice and in decision-making would do much to dispel vessel operators' distrust of management decisions. At present scientific advice is given as a set of options. Determining the implications of the risk associated with the options is reserved by the scientists for themselves and not given to the fishery managers.

Subsidiarity provides flexibility which allows fishing vessel operators to play a role through POs and other organisations in quota management and for regulations to be more adaptable to local conditions. However, the differences in how fisheries are managed in different Member States or localities can also create anomalies which undermine vessel operators' perceptions of the impartiality and legitimacy of the management system.

Divergence and compatibility of the management system

In theory, in the absence of transition costs associated with economic and social adjustment, and predatory practices by large companies, harmonisation of operating conditions and the consequent removal of economic distortions are necessary for economic efficiency.

The existence of transition costs or anticipation of predatory practices by large companies, provides reasons for retaining provisions to protect certain groups of fishermen or communities highly dependent on fishing. For such reasons, different management structures might be deemed appropriate for coastal fisheries from those for offshore fisheries. Despite running counter to single European market provisions, divergence of management approaches deemed necessary in order to protect fisheries dependent regions would be in line with existing relative stability provisions and with current trends towards integrated coastal zone management.

Explicitly taking account of socioeconomic objectives in the management structure used could be expected to increase the acceptability of proposed changes. This is especially the case as considerable concern currently exists amongst some fishing communities that they would be unable to survive some potential changes in the CFP management regime. For instance, small-scale fishermen tend to fear not only competition from large vessels and stranger vessels in fishing their traditional inshore grounds, but also the impact of regulations such as the introduction of designated landings ports.

In any multi-layered management structure, consideration is needed of the interface between the different layers. Such compatibility is currently also an important consideration in other contexts. For instance, the compatibility between fisheries management regimes between different measures used for multispecies, multiple gear, or multiple jurisdiction stocks is also pertinent.

A strong case exists for taking a more integrated fisheries management approach. Currently a piecemeal approach to management is taken which reacts to the condition of individual stocks, with a plethora of measures used, varying not just between fisheries, but nationally, regionally and between vessel types. An integrated fisheries management approach would be characterised by greater coordination at European or regional level to plan the management of the fisheries, ensure compatibility between the measures adopted in different fisheries and avoid complexity.

Insofar as subsidiarity allows for differences in management measures and their enforcement, this conflicts with the aims of the single European market in promoting the harmonisation of operating conditions. By creating competitive disadvantages for some vessel operators, differences in management measures and enforcement create economic distortions and reduce the acceptability of the management system to those fishermen who are disadvantaged.

Management Level

The various elements of decision-making, administration and enforcement could be undertaken on a European, regional (supranational), national, or local basis. Drawing upon the above discussion of co-management, subsidiarity, divergence and compatibility of management systems, the advantages and disadvantages of management undertaken at different levels are considered below. Although fisheries management might instead be undertaken by a group comprising the European maritime states alone, there are at present only 2 non-maritime Member States. Thus this option is not considered separately

Fisheries management at any level encompasses four fundamental roles:

The definition of fishing rights and management rules
The creation of a mechanism to allocate fishing rights
The enforcement of fishing rights and management rules
Co-ordination with other management authorities

As an example of the first role, a common management rule which currently applies throughout the EU is that any commercial fishing vessel must hold a licence in order to fish. At present ownership of such fishing rights is restricted to companies registered within a given Member State. However, in a similar way to foreign ownership in other industries, fishing vessel license transfers can occur by foreign fishing companies establishing themselves in another Member State and buying a license from an existing vessel operator, or partially, by foreign owners buying shares in existing fishing companies. This is analogous to the way that Japanese companies have set up car, or electrical goods production plants in various Member States.

European Management

Advantages

The aim of creating a single European market by promoting the harmonisation of operating conditions provides a powerful argument for a unitary European-wide management structure. The creation of a coherent overall European fisheries management policy and the promotion of compatibility between rules adopted in different fisheries and areas can only be achieved by involving all Member States.

Introducing a common European fisheries management system and enforcement regime so that vessel operators in each Member State face the same conditions, is likely to enhance the legitimacy of the management system and structure by increasing perceptions of fairness.

In many ways the case for enforcement to be undertaken at the European level seems compelling. An European Union enforcement agency could be expected to reduce competitive disadvantages arising

from relatively poor enforcement in certain Member States. In addition, it might overcome the temptation for national and local administrations to succumb to free rider type pressures for less stringent treatment of local vessels.

Although not all Member States have maritime coasts and registered fishing vessels, sea fish is consumed in all, so that each does have a legitimate interest in the health of the European fish stocks and catching sector. Both the industry and consumers have an interest in the stability of supply at reasonable prices.

Disadvantages

Without more direct involvement, fishermen and fishing vessel operators tend to perceive decision-making at European level as remote. Currently their role is an indirect one, involving lobbying their political representatives to achieve what they perceive to be the best possible outcome. Although European level management does not preclude co-management by fora comprising catching sector and other representatives, fostering a sense of ownership of the system will be more difficult.

The current process by which TACs are set at European level tends to undermine the acceptability to fishermen and fishing vessel operators concerned. The relative stability formula used for allocating quotas between Member States remains contentious for similar reasons.

Allocation of fishing rights at European level would be expected to increase transfers from those facing competitive disadvantages due to operating in areas with relatively strict enforcement to those facing relatively lax enforcement. It is likely to be strongly resisted by vessel operators in regions who fear that they would be unable to compete and maintain their existing fishing rights.

The creation of a European enforcement agency would raise issues of national sovereignty which may prove politically unacceptable to some Member States and conflicts with the principle of subsidiarity.

Regional (Supra-national) Management

Advantages

In addition to bringing management decisions closer to those affected, the main advantage of regional (supra-national) management is that only those Member States whose fishermen are engaged in fishing for a particular stock or in a given sea area are involved in making management decisions. For instance, a management structure could be created whereby only countries with quotas in the North Sea would be allowed to participate in making decisions concerning the management of this area.

Alternatively, management could be by a fishery-based authority. Thus covering the North Sea there would be separate management authorities for the mixed demersal fishery and the pelagic fishery. Management of the pelagic fishery would cover the whole area through which the fish migrate in Northern waters and would thus cover a different geographical area from the mixed fishery.

In line with the subsidiarity principle, the management system and structure could be more closely tailored to the specific characteristics of the fishery being managed.

The great failure of the present management systems has been in the inability of the Member States to enforce them. A regional authority with the responsibility for enforcement would be free of domestic political pressures.

Disadvantages

Depending upon whether management is stock, or area based, regional (supra-national) management would only appear appropriate in cases where a stock or area is fished by vessels from more than one Member State. Deciding which fisheries fall in these categories is likely to be contentious, reflecting complex allocational issues.

Due to interspecies effects, migration and other factors such as by-catch, the level of exploitation in one fishery may significantly influence the state of fisheries outside any given management jurisdiction. This could require negotiation between different regional management authorities to settle conflicts of interest.

Where such a system leads to different rules being introduced in different areas of management jurisdiction, this could create significant difficulties for the operation and control of those vessels participating in more than one of these. While in theory vessels could be restricted to participating in only one fishery, this is likely to be highly unpopular. Any differences in rules applied can create competitive disadvantages for some vessel operators, and reduce the acceptability of the management system to those vessel operators who are disadvantaged.

Although less so than at European Union level, decision-making at regional (supra-national) level may still be perceived by fishermen and fishing vessel operators as too remote. The exclusion of certain Member States from the EU policy-making process may be politically unacceptable to those excluded, particularly if they are contributing towards management costs, or where much of the fish caught is landed, processed or consumed in other Member States.

The permanent exclusion of vessels from Member States which have not traditionally participated in a fishery is likely to be politically unacceptable to those excluded, and may conflict with the principle of non-discrimination.

National (Member State) Management

This is the basic structure at present. Member States allocate licences and quota among fishing companies registered in their own nationality and are responsible for quota monitoring of vessels of their own nationality but enforce the common fisheries policy technical measures on all vessels fishing within their Economic Exclusion Zone.

Advantages

In line with the subsidiarity principle, this brings management decisions even closer to those affected. National management fits well with the existing principle of relative stability, as well as with the notion of national sovereignty.

Disadvantages

National management would appear most appropriate in cases where a stock or area is fished only by vessels from one Member State, such as within coastal zones. Conflicts over grounds, stocks, or activity between fishing enterprises must be resolved through bilateral or multilateral negotiations (e.g. at regional or European Union level), so that such a management structure would continue to involve political bargaining between Member States.

However, even where a stock or area is fished only by vessels from one Member State, interspecies effects, migration and other factors may also create conflict. This suggests that such a management structure requires a means of coordination at regional and European level.

Differences in local rules, enforcement, and harvesting rights such as quota allocations, can create competitive disadvantages for vessel operators in some countries, reducing the acceptability of the system to those fishermen who are disadvantaged. Such differences contrast especially starkly in cases where companies operate vessels in more than one Member State.

Local Management

Many smaller fisheries around the European Union continue to be managed at the local level within the framework of the CFP.

Advantages

This brings management decisions down to the level nearest to those most affected by them. The feeling of proximity to the decision-making process may mean that management measures are better tailored to local conditions, may create a better understanding of the reason for the measures, and should therefore engender a greater willingness to accept restrictions on activity.

Disadvantages

Local management would appear most appropriate in cases where a stock or area is fished only by vessels from one locality, such as inshore mollusc grounds. In other cases, conflicts of interest would arise between different local administrations, which would need to be resolved through national, bilateral or multilateral negotiations.

However, even where a stock or area is fished only by vessels from one Member State, interspecies effects, migration and other factors may also create conflicts of interest between local and national administrations.

Differences in local rules, enforcement, and harvesting rights such as quota allocations, can create competitive disadvantages for vessel operators in certain localities, reducing the acceptability of the structure to those fishermen who are disadvantaged. Such differences contrast especially starkly in cases where companies operate vessels under more than one management authority.

Thus this structure is practicable only for smaller coastal fisheries.

Output Controls

TACS and Quotas

Many alternative management systems to the ones which currently exist within the EU, including ITQs and quota fees, are based upon quotas and therefore require the retention of a TAC and quota regime. TACs are a constraint on economic activity and must be set on the basis of sound economic and scientific advice. While judging the level consistent with economic efficiency is less certain, if such economic and scientific advice is lacking owing to inadequate assessment, an evolutionary approach may still be adopted towards TACs with particular attention paid to the size and age of fish landed.

Many fisheries, including those for pelagic species, would be better managed by season rather than by calendar year. Quotas have to be for specified sea areas in order to link them to the fish stocks, as a TAC cannot properly be set other than by stock. At the end of the year or season over-quota catches that cannot be settled from the existing TAC could be settled from next year or season but with a penalty loss of quota at some pre-determined rate.

Quota-based management systems are easier to apply to single species fisheries with relatively few landing places under a single jurisdiction. Such systems are feasible for non-sedentary shellfisheries such as those for lobster and crab, as well as pelagic and demersal fisheries. Where a non-market mechanism is used, in most cases initial allocations of quota would presumably be based on historic performance of each vessel in a fishing company.

Given current enforcement difficulties in most Member States, in order to be successful, any quota-based management system would also need to substantially increase compliance. In general, the longer the distribution chain, the better the chance of enforcement succeeding. It is highly unlikely that small vessels pulled up onto a beach and supplying local fishmongers and caterers could be effectively policed. To achieve economic efficiency and sustainability all quota-based management systems are dependent on reasonably accurate stock assessment and effective enforcement.

Greater efforts to monitor landings, enforce quotas, and penalise over-quota landings and misreporting are necessarily unpopular with those currently breaking the rules, especially where they perceive that their operations would become unviable as a result. Support could be expected from vessel operators currently abiding by the quota restrictions, and more generally, if accompanied by other changes in the management system or structure perceived as necessary to improve the existing system, or make it fairer.

Unless a rule is strictly enforced that all fish caught has to be landed, by placing limits on the quantity of fish landed, all quota-based management systems tend to exacerbate discard problems. In theory the problems of discarding associated with a mismatch between quota allocations and the relative proportions of quota species caught can be reduced by taking a multispecies approach to setting TACs, so that quota levels for different species reflect the relative proportions caught. In practice it can be difficult to predict with precision what the relative proportions of different species caught will be since relative abundance varies from ground to ground. However, management systems where vessel operators are allowed to trade quota allocations in the light of their actual catches could help reduce this type of discard problem.

Furthermore, under a quota system, vessels fishing for species not covered by the quota system can also lead to significant discard problems if by-catches of the quota species are taken. This is especially the

case where fishing for other species continues after a quota has been taken. While the discard problem can be reduced by allocating a by-catch quota to vessels targeting non-quota species, it also can be difficult to predict with precision what the relative proportions of quota and non-quota species caught in such fisheries will be.

In an analogous way to other management systems, any quota-based system would increase the relative benefits of fishing for unregulated species, thereby encouraging vessel operators to switch to targeting non-quota species and increasing the pressure in such fisheries. In order to prevent a race for fish, guarantees would be needed that fisheries would not be closed before a holder had fully taken its quota, or adequate penalties put in place for over-catching and compensation for those unable to fully take theirs.

In each case it is suggested that transition to the new system must include acceptance of current levels of landing in making the initial allocation of quota and set the TACs at that level for two years. Allocation of official landings plus an estimate of illegal landings to acknowledge the extent of non-compliance would reward those who have adhered to quotas in the present system relative to those who have not.

Setting aside the scientific advice for a short period would run a slight risk of a year's recruitment failure in North Sea cod or plaice and might have considerable implications for North Sea herring. No other stock in European waters is thought to be under such an immediate threat. Should a recruitment failure of cod or plaice occur in North Sea then the situation can be corrected by lower TACs after the event. This would be a justifiable slight risk in order to get in place a system which should enable effective stock conservation. For herring the situation may be different. It is much easier to overfish pelagic stocks because of their shoaling habit. Unless the North Sea herring stock recovers from its current depressed position then setting aside the scientific advice would be unwise.

Quota Fees

Working Environment

The way in which quotas are allocated to vessel operators within Member States would necessarily depend on whether quota fees are fixed at European Union, national, or local level. If the principle of relative stability is to continue, existing national quota allocations could be retained but this is not a necessary precondition for the system.

Whichever level is chosen for fixing quota fees, if they are set such that demand for quota exactly matches supply, no other allocational mechanism would be required. However, if quota fees were fixed at European Union or regional level, matching supply and demand could only in general be expected to be achieved in the absence of a national quota allocation system.

If quota fees are set at a level where the demand for quota exceeds supply, some other rationing mechanism would be required to allocate quotas between vessel operators. This might be based upon vessel characteristics such as size, the number of fishermen employed, or simply upon past catch records. (If quota fees are set at a level where the demand for quota is below supply, obviously no other mechanism would be required to allocate quotas).

The principal requirements are for a TAC and quota system, appropriate mechanisms for setting and collecting quota fees, and for ensuring that individual vessel operators do not exceed their quota.

The System

Fees charged per quantity of quota should vary according to the factors which influence the size of the externality present. These depend upon the species, age or size of the fish, potential for further growth and congestion. However, charging a fixed fee per tonne of the particular quota species, such as is done currently under the Namibian system, would be simpler and is likely to be more feasible in fostering economic efficient harvesting and stock conservation.

Where quota is not caught a full rebate should not be given in order to reflect the opportunity cost of failing to take the quota. By providing a further incentive for vessel operators to catch their quota, it would be likely to reduce the likelihood that the fishing opportunities allocated will not be fully taken up.

At the cost of reducing theoretical economic efficiency, rebates could be given to certain categories of vessel operators for socioeconomic reasons by region of landing. This might be deemed especially desirable initially in order to help allay concerns that certain groups would be unable to compete.

Care would be needed to ensure that the fees charged, together with differences in landing prices and harvesting costs, do not exacerbate discard problems associated with high-grading.

A gradualist approach to increasing quota fee levels would have the advantage that the system would not result in vessel operating costs changing dramatically thereby causing many operators to become unviable. It would certainly be easiest to introduce or increase quota fees in years associated with relatively high stock abundance or other favourable factors, when unit fishing costs are relatively low.

At a given price the amount of quota sold is unlikely to exactly match that intended to be sold by the fisheries managers, since other demand factors may increase or reduce the attractiveness of purchasing quota. To overcome this drawback it would be necessary to sell quota only for short periods, say a month or a quarter, rather than a full year so that the fee could be adjusted as the fishery progressed. Otherwise some less efficient means of rationing might prove necessary if the fee were to prove too low for the price mechanism to sufficiently limit demand. While setting quota fees at a level where demand exactly balances supply is difficult without using a non-market allocative mechanism, it can easily be achieved by auctioning or tendering (see tendered quotas below).

Advantages

A system of quota fees has the potential to overcome the market failure problem by increasing individual vessel operators' harvesting costs to incorporate the externality created by their fishing activity.

Fixing the level of quota fees at European Union-level would have the advantage of simplicity and help to ensure that standard conditions apply to vessel operators, in line with provisions aimed at creating a single European market. Fixing the fees by auction would have the advantage that the TAC can be matched exactly to demand, which would encourage economic efficiency in terms of minimisation of harvesting costs.

Shortcomings

The effect of quota fees on total fishing activity is uncertain. As with a royalty or demand management system, in the short-run, raising vessel operating costs by charging quota fees could encourage fishermen to fish harder to try and compensate for higher costs by larger catches in order to maintain earnings. This would tend both to increase the pressure to break the quotas and to increase the level of fishing for non-quota species.

Fixing quota fees at national or local level is likely to lead to competitive disadvantages being created owing to different charges being made for quotas in different countries or localities. In addition to being contrary to the harmonisation of operating conditions in the single European market, this would tend to result in dissatisfaction on the part of those vessel operators disadvantaged, undermining the legitimacy of the system.

Conservation and Sustainability

Conservation and sustainability would be ensured primarily through the TAC and quota system but subject to effective enforcement.

Industry involvement in Management

It is unlikely that responsibility for management of a quota fee system could easily be devolved to local vessel operators or fishermen's organisations, as there would be a fundamental conflict of interest concerning harvesting costs.

Tendered Quota

The System

The system is simple enough in that tenders for allotments of non-transferable monthly, quarterly, or annual quota could be invited and allocated by normal market procedures.

An alternative would be to auction quota. There is no significant difference from a tendering system. It is a matter of administrative convenience for the managing authority which alternative is to be preferred.

Tendered quotas are almost synonymous with an ITQ system where there is a sole owner - in this case a government in its capacity as the representative of society - which leases quota to vessel owners.

Advantages

The system avoids the problems of equitableness of initial allocation associated with ITQs and is probably closer to European attitudes to private and public property. The system removes the market failure, is relatively simple to administer, and extracts some of the economic rent for society rather than giving a windfall asset to a private party. It is flexible and does not create a barrier to entry or unfair competition between first and second generation entrants to the industry under the system.

There would be some assistance to enforcement as those who had purchased quota would quickly resent the activities of
quota-breakers. The system would produce an economically efficient low cost industry, providing TACs are set correctly.

Fixing quota fees at national level by auction has the advantage that the supply of quota can be matched exactly to demand, which can still be consistent with national quota allocations allowed for under relative stability provisions.

Shortcomings

It will take some time for industry attitudes to adjust to having to purchase quota and for a while this might prove a problem politically. Nevertheless, given the experience of ITQs it is possible to expect that the system should prove sustainable in the long-run though it has yet to be tried anywhere.

Transition

Because of the political problems that would occur in the inception of tendering for quota it would be necessary, except perhaps for two or three seriously threatened stocks, to set TACs to levels consistent with the real level of landings including illegal landings for the first few years, only later tightening the TAC to begin the move towards economic efficiency and sustainability.

Conservation and Sustainability

Subject to the TACs being correctly set a tendered quota system will ensure good stock conservation and sustainability. The system's impact on discarding is uncertain but it would encourage good practice among fishermen as higher TACs would mean lower unit quota costs. Non-transferability might cause greater than necessary discarding. However, this would be minimised by a shorter, more flexible, period for the quota.

Industry involvement in Management

Industry involvement in the tendering (or auctioning) process would help its running, and there is a clear role for Producers Organisations and the like in monitoring quota records.

Individual Quotas

Initial Allocation

Allocations of quota made on annual basis with no direct trade allowed between fishing companies, would presumably be based on the historic performance of each vessel owned by existing fishing enterprises.

Working Environment Needed

The longer the distribution chain, the better the chance of enforcement succeeding. It is highly unlikely that small vessels pulled up onto a beach and supplying local fishmongers and caterers could be effectively policed.

The System

Like other quota-based management systems, individual quotas are widely applicable, with variants of the system already used in the UK and in some other Member States. However, in order to reduce discards, in multispecies fisheries quota allocations need to be made in proportion to expected catch rates of the different quota species.

Apart from requiring the allocation of quotas and monitoring of quota take-up on an individual vessel basis, the system is administratively simple. With the exception of discards in multispecies fisheries arising from quota allocations failing to reflect the actual catch rates of the different quota species, the system is flexible in being able to adjust quota allocations to reflect available fishing opportunities.

Vessel operators would be allowed to catch their quota without time restrictions. This would prevent the anticipation of the fishery being closed prematurely causing a race to fish with associated harvesting inefficiencies.

In order to prevent over-reporting, future quota allocations would not be linked to past quota take-up. Instead, the expected quota take-up would be used in determining the TAC.

As with other systems, effective enforcement is vital to achieving any degree of management success. Although reducing the number of harbours where fish is landed, or markets through which fish could be sold, would assist enforcement by permitting easier monitoring and weighing of boxes, this is unlikely to be politically acceptable in those Member States with extensive coastlines.

Advantages

Providing the fishery remains open for its full term, individual quotas could end the race to fish. This could lead to some improvement in the quality of fish landed since there is an incentive to the fishing company to enhance the value of its limited catch.

Individual quotas may reduce enforcement problems. Despite not being directly tradeable, allocation of individual quotas necessarily creates a private property right which could assist enforcement by increasing support for effective enforcement measures. Restrictions on quota tradeability may offer protection to communities highly dependent on fishing, although these could be of somewhat limited value in practice, as the current controversy concerning quota-hopping illustrates.

Shortcomings

Representing in essence a form of administrative rationing, there is minimal incentive to reduce over-capacity at fleet level, or to encourage economic efficiency. A most significant weakness is that the practice of discarding saleable fish will continue.

If quota allocations can be transferred when vessels are sold, the system risks being transient. As in the Dutch case, the system is likely in practice to become a restrictive form ITQs, with the value of quota allocations being capitalised in the selling price of the vessel.

Effective enforcement has been one of the principal weaknesses of such systems already in operation within the EU. The mix of overcapacity, low quotas and lack of enforcement has led to management failure.

Differences in quota allocations are likely to remain highly contentious and detrimentally to affect vessel operators' perceptions of equitableness and their willingness to accept the system.

Transition

To preserve local employment and income, provisions would be required to prevent the sale of vessels with quota allocations to fishing companies from outside the country, such as through compulsory membership of national vessel operators associations such as POs. Only if single European market provisions were to take precedence over the relative stability principle, could free trade between companies within the EU be permitted.

Due to the level of capital written off in company financial accounts but remaining in reality it is likely that a decommissioning scheme funded from taxpayers funds would prove necessary to supplement the scheme in its initial stages.

Conservation and Sustainability

With adequate enforcement an individual quota managed fishery should prove sustainable.

Industry involvement in Management

Management of quotas could be handed to fishing company groups, as already happens in the UK.

Individual Transferable Quotas

Initial Allocation

The initial allocation of quota must be of a given percentage of national quota, regional quota, or stock TAC, depending on the management level chosen, rather than a defined tonnage. A tonnage measure would expose governments to the risk of the need to repurchase quota at great cost should a stock collapse for unseen reasons.

Such an allocation of quota may be either in perpetuity or for a given period. The quota can then be traded or leased between fishing companies or others.

Working Environment Needed

Enforcing the system would be complex but could be achieved by creating Licenced Fish Buyers, who would have the exclusive right to purchase fresh fish landed, and following an audit trail of sources of fish purchased by them.

ITQs need an environment which simplifies the complexities of enforcement but which is sufficiently relaxed to allow the market they create to operate relatively freely - otherwise they will not work. The fewer rules governing sales and purchase of ITQs the better the system can work.

The System

It is essential where the fisheries are shared between member states that the system be equitably applied and enforced to suppress the free rider problem.

Quantities of fish purchased by licenced fish buyers would be expected to match their output and could be verified by an audit trail. Thus overfilled boxes would be discouraged by the monitoring system. Alternatively, the system could be enforced providing there were relatively few ports, or markets through which all fish had to be landed or sold.

Exempting small vessels from the scheme would create considerable difficulties. In Iceland the small vessel sector grew substantially when exempted. In New Zealand, small part-time fishermen were removed from the industry at the commencement of the system. The position of part-time and very small vessels would have to be considered very seriously in any new system.

It is essential to allow the purchase of quota after catching to reduce the incentive to discard. This is fundamental to the efficient operation of the market in quota and conforms to the way business operates in many other sectors of the economy.

Period of Ownership

Distribution of quota involves a transfer of ownership from the state to private owners. Allocation for a given period reduces the effectiveness of the market significantly because the asset value is reduced accordingly. The present value of the asset only has the stream of benefits over its lifetime capitalised within it and the incentive to conserve the fishery is thus eroded. This may also worsen the position of would-be borrowers when the value of the asset held by the fishing company is needed as security, say for a bank loan for a new vessel. Allocation in perpetuity, on the other hand, may create legal complexities if at some stage a desire develops to abolish the system.

Advantages

There is no doubt that in theory ITQs have the potential to solve the problems of economic inefficiency caused by the market failure present in most unregulated or improperly managed fisheries. In particular in Europe the race to fish would end providing the fishery remains open for its full term, and the endemic overcapacity would disappear after a period of adjustment.

There is likely to be an improvement in the quality of fish landed under the system since there is an incentive to the fishing company to enhance the value of its limited catch.

Finally, the system would serve eventually to decommission excess capacity with those companies leaving the industry receiving financial recompense as a result of the sale of their quota and without recourse to taxpayers funds.

It should be noted, however, that it does not automatically follow that there will be fewer vessels or lower employment in the fishing industry, but distortions in the mix of capital and labour produced by attempts to evade the present system will be shaken out. If stocks recover in number or weight there may or may not be opportunities for additional capital and labour inputs.

ITQs offer no immediate solution to the problem of enforcement. However, the creation of a private property right to fish the stocks will provide a tangible asset for fishing businesses, and assist in enforcement since an understanding that exceeding quotas reduces the asset value of others will create support for effective enforcement measures. The Dutch experience has shown that ITQs change attitudes within the fishing industry towards over-quota landings and create a demand for effective enforcement. This makes enforcement easier for the political and administrative authorities.

Shortcomings

The most significant weakness is that the practice of discarding saleable fish may continue. Because fishing gear is not perfectly selective some discarding of young fish is an inevitable part of the fisheries production process. It is possible that discarding under an ITQ system may either increase or decrease. This should be weighed against the improvement in the size of stocks and the conservation of small fish

that should be encouraged. Much depends on the growth rate of a species versus the natural mortality rate, as well as market demand for larger or smaller fish of a given species.

The creation of an asset with value will mean that fishing companies must beware the effect on their financial position of inheritance laws and taxes. The asset value may, however, serve as a barrier to entry to the industry. In the short-run, given excess capacity, this may be useful but it could prove a problem at a later date.

There is a risk - it is by no means a certainty - that small remote communities would face the loss of a source of income. Such a source of income has been declining with the fisheries and faces continued decline if nothing is done to improve management. If stocks regenerate then local communities could benefit. Part of the purpose of allowing fishing company groups to manage their quota would be to allow them to balance keeping their activities local with the costs involved. The problem would be greatest in Greece, with its multiplicity of islands. Some special provisions such as exemption from the policy because of the short distribution chain or allowing the local police to act as fishery officers might be necessary.

As time progresses fishing companies may become larger and less identified with families and communities. Some continuing monitoring as the industry rationalises and restructures itself will be necessary.

Transition

Gradual introduction of the system would ameliorate the immediate negative effects of introducing the regime and allow time for individual portfolio and regional economic adjustment. To preserve local employment and income, sale of quota should be restricted for a few years, first within Producer Organisations or similar groups only, then between fishing companies within a country, later between fishing companies throughout Europe, and finally to any individual or company which wishes to purchase quota as a portfolio investment. This could be achieved by restrictions on licences. The final stage in particular will not be especially popular at present. However, to do otherwise will be to artificially depress the value of the quota to those holding it from the initial free allocation or to those who have purchased it as the market was gradually freed.

There are undoubtedly effects on the distribution of wealth and income within regions that will demand care in setting up such a system. However, the windfall received by those who receive the initial allocation will be reduced by the restricted market first created by sale within fishing company groups. This will also reduce the pressure on second generation purchasers of quota and reduce the barrier to entry experienced by newcomers to the industry.

Initially the system should be applied to pelagic fisheries such as North Sea herring. Northern European Pelagic fisheries are normally single species fisheries and have relatively few landing places. The system could be applied throughout European Union waters including, later, the Mediterranean. After a couple of years the system could be extended to all demersal species, and non-sedentary shellfish such as lobsters, crabs, shrimps, and nephrops (scampi prawns) and the sale restrictions gradually eased. The system might also be applied to sedentary shellfish though it could comfortably work alongside a system of coastal seabed ownership if that were preferred.

Due to the level of capital written off in company financial accounts but remaining in reality it might prove necessary to supplement the scheme in its initial stages with a decommissioning scheme funded from taxpayers funds. Such a demand would be reduced by the value of the quota asset held by the decommissioning fishing company. A system of resource rental for holding quota could be applied in perpetuity to recover the taxpayers funds used in the decommissioning scheme.

Conservation and Sustainability

ITQs offer an effective incentive to the industry to conserve spawning stocks and allow young fish to grow. However, sustainability will be challenged in any system if the fishing companies have a positive relative discount rate (that is, a greater preference than the government for a benefit now rather than later). Hence the continued need for enforcement measures. Nevertheless, with adequate enforcement an ITQ-managed fishery should prove sustainable.

Industry involvement in Management

Management of quotas could be handed to fishing company groups, as already happens in The Netherlands. It does not matter whether these groups are existing ones such as Producer Organisations or Cofradias or are specially set up. Fishing enterprises currently outside membership of such organisations would have to be required to join otherwise the principle of local management will be frustrated.

Regional Enterprise Share Quotas

Initial Allocation

Share quotas are allocated on a long-term basis to regions, with these Regional Share Quotas (RSQs) being sub-divided and allocated to licensed enterprises within each region. The licensed enterprises would be owned primarily by fishermen. However unlike POs, the licensed enterprises would include fishermen without ownership shares in vessels, rather than purely vessel owners, thereby broadening the ownership base of the fishing rights.

Working Environment

The principal requirement is for a TAC and quota system which incorporates a regional and enterprise quota management structure.

The System

Licensed enterprises owned primarily by fishermen would be free to decide how many vessels to use to take their quota. A limit would be placed on the maximum proportion of these Regional Enterprise Share Quotas (RESQs) which would be transferable.

This system would be similar to ITQs, except that quota allocations would only be partially transferable and held as common property rather than private property. Quota shares would be held by regionally-based fishermen's organisations, rather than by individual fishing companies, with the government retaining the right to reallocate quota shares to new enterprises, or specific regions.

In addition to requiring strict compliance with the quotas, like ITQs, such a system would necessitate careful monitoring of all quota trading transactions. Not only would guarantees be needed that a fishery would not be closed before an enterprise had fully taken its quota, but within regional enterprises care would be needed to ensure that a race for fish did not occur between vessels operating on behalf of the same enterprise.

Advantages

The system offers greater protection to communities highly dependent on fishing and reduces the potential for concentration of quota ownership in the hands of the most efficient vessel operators. Initial allocation of quotas could be made in a similar way to the method of national allocations currently allowed for under the relative stability principle, but with quotas allocated on a regional basis, rather than purely on a national basis.

The system could be expected to receive wide support by those concerned to maintain existing quota shares, avoiding significant regional redistributive impacts or deleterious effects on fisheries dependent areas.

Compared to an ITQ system, quota trading would be more restricted and occur between larger units, implying fewer transactions and lower monitoring costs. At the cost of increasing regional impacts, it would be relatively easy at a later stage to remove quota trading restrictions in order to increase incentives for cost minimisation, or even to change from RESQs to ITQs if this came to be seen as desirable.

Short-comings

Initial allocation to regions and enterprises is likely to entail considerable conflict over the criteria used for making allocations. Anticipation of the likely basis to be used for initial allocation is likely to lead to strategic behaviour on the part of fishermen, whereby they change their fishing activity patterns in order that an enterprise they join qualifies for the greatest possible initial quota allocation.

RESQs may be too restrictive to allow a proper market for the quota to develop and fail then to completely overcome the market failure. In addition, they are untried, and their institutional complexity adds to the risk of the system having unidentified weaknesses.

Transition

A management system based upon regional enterprises could be achieved either by creating new organisations, or by modifying the existing POs, *Cofradias*, or other structures. Either option could be expected to be achieved at relatively little cost. To some extent the system appears comparable to the

existing PO quota management system currently used in the UK, where POs can trade quotas and the vessel track record upon which quota allocations are based.

Conservation and Sustainability

Conservation and sustainability would be ensured primarily through the TAC and quota system.

Industry involvement in Management

Management of quotas allocated to regional enterprises would be largely devolved to the fishermen concerned. However, regional, national and European Union authorities would still need to be assured of compliance with quota allocations on the part of regional enterprises.

Royalties

Initial Allocation

Strictly, there is no need for an allocation of rights under this system but current licence holders could at first be given an exclusive right to fish.

Working Environment Needed

Charging royalties demands that the enforcement agencies are able to keep track of landings or of buyers. For the system to be effectively applied in Europe the same considerations might apply as for ITQs; namely, licencing of fish buyers, or a relatively small number of landing ports or markets, and a distribution chain of reasonable length.

The System

Royalties involve a charge on landings. Such a charge would need to be administered on a common basis whether by regional or national authorities. The royalty might need to take into account exchange rate changes since the royalty will need to internalise the international economic cost of fishing. If royalties were to be set at a European or regional rate a decrease in the level of a domestic exchange rate will discourage fishing companies from fishing. To be meaningful the charge must vary according to the species landed.

Advantages

Royalties are a relatively simple means of redressing the market failure by charging for the fish taken. Courts take a more serious view of evasion of taxes and duties than they appear to take of quota evasion.

The system must operate with a TAC implied by the level at which it becomes uneconomic to continue fishing a species. A distinct advantage is that where scientific assessment of stocks is limited an evolutionary approach to the level of royalty can be used to reduce the amount of fishing, eventually to allow stocks to recover and then find a long-run relatively stable level of royalty and stock. This will be more difficult with species with a relatively short life-span or very variable recruitment patterns.

Shortcomings

A difficulty with royalties is that they will inevitably be perceived as a form of tax, and in addition one levied on food. It is likely that the system would substitute annual discussion over the level of royalties for that over TAC levels. The purpose of royalties is to make it uneconomic to fish beyond a notional, but essential, TAC. Setting royalties at a level to achieve this will be very difficult and it is quite possible that the royalty might need to be adjusted on a monthly or quarterly basis. Politically this might prove difficult to sustain.

The incentive to misreport still remains and the system would be no easier than the present system to police unless those paying the royalties were to apply peer pressure or the force of the authorities against those who attempt to break the regulations. With the current levels of overcapacity the strength of this incentive must not be underestimated.

Transition

The system could be applied generally and with relatively low royalties at first in order to gain acceptance and test the system. Later the royalty would need to be raised to allow stocks to recover and grow to an optimum biomass and size of individuals. A long view needs to be taken at the outset.

A decommissioning scheme funded from the proceeds of the royalties would be necessary in the early years of the system (at least up to the point where stocks begin to recover) to reduce the number of marginally productive vessels to a level which minimises the incentive to evade royalties.

Conservation and Sustainability

TACs are needed for this system and similar problems apply to compliance as exist for the existing system except that the requirement to discard is removed. The system does offer conservation and sustainability if enforced effectively.

Industry involvement in Management

Industry involvement in management under this system is likely to be fairly limited.

State Monopsony

Monopsony exists in a market where there is a single buyer.

Working Environment

In order to avoid free rider problems, the system would need to be comprehensive, covering all vessel operators fishing the stocks being managed. Information on vessels' catches at the locations fished would continue to be needed (e.g. log book data), as in most instances it is unlikely to be practical to identify at point of landing which particular stock the fish had come from.

The System

Commercial fishing vessel operators will only go fishing providing they expect to at least cover their operating costs from the proceeds of the fish they will offer for sale. If prices are too low for a species, fishermen will tend either not to go fishing, or to discard the particular species and land only higher value species.

The price received for the fish landed is therefore an important determinant of the amount of fishing which occurs, the level of catches and of landings.

With many buyers, the price vessel operators receive for the fish landed is generally determined by the operation of the market, adjusting price levels until supply is equal to demand. In some fisheries prices are fixed for the duration of a fishing season by negotiation between vessel operators and buyers. For instance, in Scottish pelagic fisheries, it was usual for fixed prices for the season to be negotiated with the Russian and East European klondykers which purchased most of the catch.

Landings prices could also be used by a management authority wishing to utilise economic incentives to alter the level of fishing and landings. For instance, a rule might be introduced whereby vessel operators are required to sell their catch through a fisheries management board at prices compatible with the desired level of landings. The management board might then
sell-on the fish through the auctions in the normal way, with strict enforcement to ensure that landings are not sold directly by vessel operators.

Under such a system, the difference in sales revenue between that received by vessel operators and that paid by fish merchants and processors (economic rent) would have to be used for purposes other than the remuneration of fishing vessel operators. It could be used to meet the costs of fisheries management and research costs, and to contribute more generally to public finance.

Setting a fixed landing price for all vessels for any given size, quality and species of fish would have the advantages of simplicity while encouraging cost minimisation in harvesting.

At the expense of cost minimisation incentives, flexibility could be incorporated to safeguard the interests of particular groups, or in order to further other management objectives. For instance, where employment in fisheries is viewed as an important objective, or where small vessels are not expected to be able to compete with larger vessels, a system of higher prices paid to smaller vessels than to larger ones might be used.

In order to encourage the use of more conservation-friendly fishing gear and the reduction of discards, higher prices might also be paid to vessels using certain types of gear (e.g. larger mesh nets).

Advantages

A demand management system need include no other form of input or output control. Fisheries would remain essentially open access without the creation of private property rights and associated legal or financial barriers to potential new entrants. Rather than entailing privatisation of the stocks, these would remain common property.

Setting fixed landing prices at all European Union ports for any given size, quality and species of fish would have the advantage of simplicity. Similarly, setting prices on an annual basis would have the same, while assisting enterprises in planning their activity by being able to count on stable prices.

The system would be relatively simple to administer.

Shortcomings

Price differentials currently exist between European Union ports that reflect national and regional variations in supply and demand. Thus, setting fixed landing prices at all ports for any given size, quality and species of fish would have the disadvantage that these would fail to incorporate existing price differentials thereby distorting economic incentives. Similarly, to the extent that price differentials currently vary systematically between weeks or months reflecting seasonal variations in supply and demand, setting prices on an annual basis would have also distort economic incentives.

If price differentials between vessels were sufficiently high, there would be incentives for evasion by transshipment of catches prior to landing in order to maximise sales values. Setting different price levels for different categories of vessels involves allocational decisions, which are likely to be controversial.

Conservation and Sustainability

Increasing technical efficiency over time would be expected to lead to a continuous reduction in the prices associated with any given level of landings, and a sustained increase in economic rent.

Industry involvement in Management

Extensive industry cooperation would be needed to provide the comprehensive costs and earnings data on a vessel trip basis required for calculating appropriate landings price levels.

Input Controls

Exclusive fishing rights: Seabed Plots

Initial Allocation

A management authority could allocate without payment, lease, or sell in perpetuity rights to fish for or cultivate sedentary shellfish in a given area. As the market failure problem is more likely to be overcome, the option of selling or allocating rights in perpetuity is focussed upon. If instead exploitation rights were sold for a limited period, the enterprise purchasing the rights would have an incentive to exploit the fishery only taking into account marginal revenues and marginal costs over the time-span of the fishing rights. In general, the shorter the time-span, the smaller the incentive for the enterprise to exploit the fishery on a sustainable basis.

Working Environment

The principal requirements are for appropriate mechanisms for demarcating, allocating and enforcing the exclusive fishing rights. Assuming transfer of rights is allowed, a system for monitoring ownership transfers is required.

The System

Holders of the fishing rights would be free to choose how many vessels or other equipment to use and how many fishermen to employ.

Advantages

Where a self-contained fishery is exploited by a single operator the free rider problem does not arise. Allocating or selling rights in perpetuity has the advantage that the market failure problem may be overcome, resulting in the minimisation of harvesting costs and the maximisation of economic rent.

As previously noted, a system of exclusive cultivation rights has been successfully used in coastal waters for mollusc cultivation in some Member States, including the Netherlands, where sea bed plots are allocated to individual enterprises.

Shortcomings

Dividing fisheries by area so that they form separate entities for management purposes can pose significant difficulties, especially where different stocks are fished in an area. Reaching agreement to exclude activities which would conflict with the sedentary shellfish fishery are likely to be highly contentious and unless adequate compensation is offered, are likely to be strongly opposed by those excluded.

In cases of such very slow growing stocks, there would be an incentive for a profit-maximising enterprise to equate the

short-run marginal revenue and marginal cost of fishing, and increase its catch towards the open access level. Such behaviour could lead to stock collapse.

Any difference between the enterprise's discount rate and that considered socially optimal would lead to a harvesting pattern which failed to be socially optimal. For this reason, depending upon the level of uncertainty concerning levels of stocks and other relevant variables, it might be preferable to retain a TAC system, so that the right holder has an incentive simply to seek to minimise harvesting costs and maximise returns within the quota. Unless harvesting patterns were expected to differ substantially from those considered socially optimal, retention of a TAC would be unlikely to be cost-effective owing to the necessity of enforcing landings restrictions, implying increased management costs.

As subdividing offshore areas poses significantly greater difficulties particularly regarding enforcement, it is unlikely that such a system could be usefully extended beyond the near inshore areas of coastal zones.

Allocating harvesting rights free of charge amounts to a windfall gain to those who receive them, creating a barrier to entry and competitive disadvantage to potential new entrants.

Conservation and Sustainability

A system of exclusive fishing rights can assist conservation and the sustainable use of resources, providing harvesting levels do not significantly influence other fisheries.

Industry involvement in Management

In such self-contained fisheries setting harvesting levels and the levels of inputs used can normally be left to the fishing rights holder. Any differences between the enterprise's discount rate and that considered socially optimal would lead to a harvesting pattern which failed to be socially optimal, which could necessitate retention of a TAC and quota system.

Tradeable Days at Sea

Initial Allocation

Days at sea allocations could be either given away free for a period or in perpetuity, or sold to vessel operators, with levels allocated being based upon previous activity records, vessel size characteristics, or simply ability to pay. We concentrate here on the allocation of a share of a Total Allowable Days at Sea (TADS) in perpetuity because such a system has a number of advantages over other days-at-sea regimes, particularly in terms of political acceptability. Initially, therefore each vessel would be allocated a share of the TADS in perpetuity.

Working Environment

The principal requirements are appropriate mechanisms for allocating and enforcement of days at sea and calculating the implications of various levels of days at sea allocations for landings and economic returns. A method of monitoring transfers of days-at-sea is needed.

The System

The number of days vessels could spend at sea in a given period would be restricted to a share of the TADS. This allocation would be divisible and tradeable and days-at-sea could be purchased in arrears. Flexibility could be enhanced by the ability to borrow from the next period's days allocation subject to a penalty greater than the market cost of days in the current period. Providing enforcement could be assured, it would be preferable for days at sea to be administered by groups such as POs and *Cofradias* in order to involve the industry in their operation.

Advantages

Restrictions on the number of days that vessels spend at sea have the advantage of ease of enforcement and consequently relatively low enforcement costs. By taking a multispecies approach to setting days at sea allocations, no restrictions on landings might be needed.

This would tremendously simplify the management system and, by reducing incentives for misreporting, could be expected to result in improved landings statistics.

Allocation of a perpetual right would be more acceptable than repeated annual allocations which would be the subject of constant political pressure.

The tradeability of days-at-sea would offer compensation without recourse to taxpayers funds to vessel operators leaving the industry. However, some supplementation by a decommissioning scheme might still be necessary.

Shortcomings

With the possible exception of using previous activity records, the basis used for initial allocations is likely to be highly contentious. The system will provide an incentive for vessel operators to try to increase their returns per day at sea, resulting in input distortions (such as double-crewing) and altering activity patterns.

Whether or not they are linked to measures of vessel capacity, if days at sea allocations are tradeable, this will tend to lead to days at sea being acquired by the most efficient operators. This is will also lead to a reduction in the number of days at sea associated with a given short-run level of landings.

Some attempt to reduce problems of input substitution leading to overcapacity could be made, such as using a system of charging for days at sea allocations. However, given the difficulties of defining the catching efficiency or capacity of vessels alluded to previously, any system of charging for days at sea is also likely to result in economic distortions.

A further disadvantage is that the precautionary approach suggests that the TADS will have to be set according to the condition of the weaker stocks.

Conservation and Sustainability

Any limitations on days at sea will tend to lead to input substitution owing to the incentive for individual vessel operators to increase their catches within their days at sea allocations. This will generally lead to a continuous reduction in the TADS as a result of technical advance.

Industry involvement in Management

Extensive consultation would be needed to resolve conflicts over initial allocations. Industry groups could assist in management of the system by monitoring activity.

Licences

There is now a licencing system present throughout the European Union. The effect of this has been to create a property right in the fishery and licences now change hands at a price which reflects their scarcity.

There is a question mark over the nature of the property right held at present by licence owners. It is possible for licences to be given in perpetuity or for a limited period. Rules relating to the transfer of licences to new vessels are at present too slack to reduce utilised capacity sufficiently quickly to outpace improvements in technology.

There would be no specific need for TACs to be set in addition to the licence regulations but to enable the condition of the fishery to be monitored and stock conservation plans to be constructed the number of licences in existence would have to be tailored to achieving the long-term industry equilibrium level of output (It should be noted that this will be consistent with a declining trend in the number of licences owing to improvements in technology). This is not an easy task since the relationship between inputs such as capital, labour and fuel, in the fisheries production process and the resultant landings is almost wholly unknown but the licence numbers could be approached by incremental changes. Thus a TAC would need to be calculated as a target figure to which the desirable number of licences in existence in any given season would have to be adjusted, and not as a figure to which landings would be directly limited.

Definition of precisely what a licence permits remains a difficulty. They must be related to a fishery and so are necessarily to be administered by a regional or fishery-based management authority. This leaves little scope for involving fishing company groups in management. In the demersal fisheries licences could be restricted to a given region or a smaller area, though the more complex the licence restrictions the harder will be enforcement. For pelagic fisheries by and large a licence should be related to a stock. This will accommodate the migratory behaviour of pelagic species. Any redistributional side-effects in Northern Europe have in practice already occurred as the pelagic catchers there are very efficient.

Although priced licence systems have been shown to be workable in some parts of the world they are not included as an option here. The reason they have been omitted is that in any market it is not strictly possible to control both the price of a good or service and the quantity of it sold unless other means of rationing are devised, such as allocating first to local vessels. Thus if the price of licences is pre-set anyone who offers the price (and meets whatever other criteria may be laid down) will be entitled to a licence. The process of pre-setting a licence price would be subject to continual pressure from the industry to keep the price down. When the price level is fixed too low excess demand for licences will develop requiring non-market allocation rules. We have therefore preferred to set out the obverse possibility where the number of licences is set according to the fishing opportunities and the price adjusts to match demand for licences to their availability.

Licences in Perpetuity

Initial Allocation

Licences already exist throughout Europe. It would present no difficulty to convert them (for certain) into perpetual rights.

The existence of licences to fish in perpetuity would expose governments to the risk of having to repurchase them should a fishery experience a serious stock decline if licencing were to become the primary management method. This would be a more serious problem in pelagic fisheries which are prone to more rapid changes in the size of stocks.

Working Environment Needed

The free rider problem must be overcome by equitable action among governments whose fishing companies share a fishery. This probably means proportionate action in allocating or restricting the number of licences, though this action itself may introduce distortions. The advantage of the system is

that if there are few enough licences landing may take place wherever a vessel chooses. It is possible to envisage that such a system would prove workable in the Greek Islands where there are many landing places and a very short distribution chain.

The System

The licence should confer a right to participate in a given fishery, where the fishery is defined by area and target species. This will allow flexibility in targeting stocks as abundance varies and allow changes of fishing method used as technology develops.

The existing licencing scheme is insufficient in its strength to counterbalance the growth in fishing power. Rules associated with transfer of licences need to ensure that the reduction in "capacity" sought is greater than the cumulative rate of technological advance. "Capacity" is in inverted commas because in fact some measure of input, such as engine power, is usually used as a proxy for capacity, which is a measure of output.

Given the allocation of licences, the means of adjustment of capacity to fishing opportunities can either be by government intervention to purchase or sell licences on the free market, or by rules which are deemed to reduce the fishing power of new vessels compared to old when the licence is transferred. Aggregation of licences would be permissible.

Advantages

The system would be simple and relatively cheap to enforce. Decommissioning would be funded by the industry with no expense to the taxpayer except when there was then need for a rapid reduction of fishing capacity. The advantages of these two characteristics is not to be underestimated.

Depending on the conditions attached to a licence, the need for by-catch rules and discarding should be minimised.

Shortcomings

This solution is essentially only short-run and it fails to address the cause of the market failure. There would be no end to the race to fish since upon acquisition of a licence the incentive to fish as much as possible remains. This still leaves fisheries vulnerable to input substitution and distortions since a fishing vessel is only one of the inputs used in the fisheries production process. Therefore capital stuffing will ensue reflecting a misallocation of resources. As the management authorities attempted to counter this trend by reducing the number of licences excessive decommissioning would develop leading to an over-capitalised fleet of too few vessels.

An additional disadvantage is that there may be no incentive to target more abundant species and avoid those whose stocks are low. It might be more profitable to target the species in short supply since they would be relatively more valuable. The extent of the price differential would determine the question, but in order to protect the more vulnerable species the management authorities would be forced to limit the number of licences to the level of opportunity those species offer, regardless of the abundance of others. Thus this precautionary approach would not allow extraction of the full economic benefit available to society.

The system is relatively intolerant of annual tuning changes to the number of licences in response to varying stock abundances. The mechanism for changing the number of licences is a sale by government of extra licences, which would be unpopular with existing licence-holders, or a repurchase of existing licences, which leaves an open-ended commitment to draw on public funds.

New entrants to the industry would have to purchase a licence either from an existing holder or in a government sale, putting them at a competitive disadvantage against the original holders.

Inheritance laws may make transfer of the licence difficult because, when shared among descendants, the one intending to remain in fishing has to purchase the shares held by others.

Transition

Transition from the present position would be a relatively simple matter. In a sense, the existence of a system of licences given as a windfall by governments to fishing enterprises already means that the first step has been taken. The fact that it is insufficiently tight at present is in the spirit of allowing the industry time to readjust and so the system could be tightened with immediate effect.

Tightening would mean a rule requiring a reduction in capacity, when transferring to a new vessel, greater than the rate of technological advance plus an additional percentage designed to reduce the number of vessels fishing to those needed to take a long-run total available catch. We have not specified precise figures here because they will vary with fisheries.

Conservation and Sustainability

This system could achieve stock conservation and sustainability. To do so it might be unnecessarily restrictive on fishing the more abundant species. Whether this is a price worth paying for the administrative simplicity of this system is a political judgement.

Industry involvement in Management

There is little scope for industry involvement in management of a fishery under this system.

Tendered Licences

Initial Allocation

This system has no need of an initial allocation but would probably prove more politically acceptable if those entitled to tender in the first few years were restricted to those with a history of fishing in the fishery for which they were tendering for a licence. This would initially serve to reduce the cost of the licences.

The System

An alternative tendered licencing system would overcome some of the problems associated with perpetual licences. The management authorities would call for tenders, say annually, for a number of licences calculated to be consistent with available fishing opportunities in each fishery. Some of the economic rent from the fishery would accrue to society reducing the tendency to overinvest.

Advantages

The system would be simple and inexpensive. Those fishing companies forced to reduce their number of fishing vessels would receive no compensation unless specific provision were made since no decommissioning would be funded directly by the industry. However, funds acquired from the tender could be used to pay for a decommissioning programme. Alternatively, fishing companies need not permanently remove their capacity from the industry but could hold it in reserve for the next tender. The system would extract some of the economic benefits of improved management for society and reduce the incentive to overinvest present in insufficiently constrained fisheries which have strong demand.

Unlike the perpetual licence system, a system of tendered licences is very flexible and could respond to changes in stock abundance.

Shortcomings

This solution is essentially only short-run. The market failure is only partially addressed and there would be no end to the race to fish since upon acquisition of a licence the incentive to fish as much as possible remains. This still leaves fisheries vulnerable to input substitution and distortion since a fishing vessel is only one of the inputs used in the fisheries production process. However, capital stuffing will be less severe since excess profits will be reduced by the cost of licences.

The disadvantage remains that there may be no incentive to target more abundant species and avoid those whose stocks are low. It might be more profitable to target the species in short supply since they would be relatively more valuable. The extent of the price differential would determine the question, but in order to protect the more vulnerable species the management authorities would be forced to limit the number of licences to the level of opportunity those species offer, regardless of the abundance of others. Thus this precautionary approach would not extract the full economic benefit available to society.

A further disadvantage also remains - that the contraction in the number of vessels induced may be greater than economic efficiency demands because of the continued need to try to curb the race to fish.

Transition

Transition from the present position depends on the legal status of the licences already in existence at the moment. If the existing licences were adjudged to have created a perpetual right, a device to avoid having to repurchase licences would be necessary.

Thus the existing licence-holders might have to become an exclusive group entitled to tender for a restricted permit to fish - effectively a second licence. Otherwise the system would be relatively simple to implement. The existence of an insufficiently tight regime at present is in the spirit of allowing the industry time to readjust but because the system is already instituted access to fisheries could be tightened with immediate effect. Tightening would mean a reduction in the number of licences (or permits) to fish.

In order to allow the industry to adjust it would be advisable to reduce the number of licences each year by a fixed given percentage plus an allowance for technological advance. Such a programme should be planned to reach a target level of capacity - defined as the landings potential of the fleet; not a continuation of the flawed MAGP targets - over a period of perhaps seven to ten years but should be reviewed after five years to check its effect on capacity and stocks. We have not specified precise figures here because they will vary with fisheries.

Conservation and Sustainability

The system would allow the development of effective conservation strategies and sustainability of fishing for many years providing the number of licences is reduced at a sufficient rate. Ultimately, however, capital stuffing will challenge the system although this may be after several decades of relatively successful operation.

Industry involvement in Management

There is little scope for industry involvement in management of a fishery under this system.

Input Taxes

The System

The idea behind a system of taxes on inputs is similar to that of royalties but charged at a different stage in the production process. The most obvious target for such a tax would be fuel but the taxes could be levied on any of the whole range of inputs used in fishing.

Advantages

The most significant advantage of imposing taxes is that they would be easier to administer than most other systems through already well established procedures for other domestic taxation measures.

A tax on fuel also fits well with current environmental concerns.

Shortcomings

There are however many disadvantages. For the system to be equitable and effective in international fisheries tax rates would have to allow for exchange rate and purchasing power differentials and to accommodate patterns of landing beyond the fishing companies' home member state.

There would need to be continual adjustment especially in the early years of the system which would raise the political profile of the system and create continual calls for reductions in the tax rates imposed. The system is not species-specific. Compounding this problem is that it might prove impossible to impose different tax rates on different fisheries (as would be desirable) because higher tax rates would be evaded by transfer of fuel from one vessel to another. Thus all fisheries would have to be treated according to the condition of the weakest. There are great problems attached to making such a system equitable across member states.

The system would lead to substitution of untaxed inputs for those taxed creating distortions, and in some cases it would be possible to evade taxes. Refuelling on the high seas from a tanker could avoid a fuel tax.

Transition

Tightening the tax rates necessary to squeeze out excess capacity would inevitably be slow and there would be a continuing need to observe and counter the effects of input substitution which developed. A decommissioning scheme would be necessary to assist in the removal of excess capacity.

Conservation and Sustainability

The system depends for its success on continual increases in tax rates in order to combat distortions arising from, for example, more fuel-efficient engines.

Industry involvement in Management

There is little scope for industry involvement in management of a fishery under this system.

Technical Measures

Technical measures alone cannot be used to produce efficient fisheries management or achieve conservation goals as they do not address the market failure which causes overfishing and overcapacity in the industry. They should be seen at best as tuning measures which squeeze slightly greater economic returns from a fishery given the management system.

Protection of Juveniles

Technical measures will continue to have a role in most management systems in order to protect juvenile stocks. Thus there may be a continuing need for minimum landing sizes, seasonal closure of nursery areas, gear selectivity measures and, for example, for schemes to protect berried hen lobsters. It is impossible to generalise about the need for these instruments and their use will have to be determined fishery by fishery according to particular stock and species characteristics.

Discarding

Some discarding may be economically efficient where there is no market for the fish caught because gear remains imperfectly selective by species or size. However, excessive discarding as a result of fishing among juvenile stocks or in order to high-grade is unquestionably undesirable. It is not immediately clear whether a ban on discarding would be desirable or enforceable. No study of this has been undertaken in the European Union.

12-mile limit

The desirability of continuing the existence of the system of exclusive national 12-mile coastal limits appears to be the one item where there is unanimous agreement among administrators and industry alike.

The advantages of the 12-mile limits are that they give greater national and local control over inshore stocks and help maintain local employment.

However, the issue continues to be a source of uncertainty in the industry and to local communities because the Commission proposes to continue the system in perpetuity by derogations from the provisions of the Treaty of Rome rather than by an amendment or supplementary clause. This is depriving the industry of confidence that the Commission's stated wish can in fact be delivered as it is well understood that the wish of the present Commission may not be that of all future Commissions.

If the 12-mile limits are to be continued in perpetuity then it would appear desirable to incorporate such a provision in one of the future Treaties which develop the structure of the European Union. If nothing else this would remove a source of suspicion within the industry as to what is being planned by the Commission for the industry's future. Such rebuilding of confidence in fisheries management is essential to the production of sound fisheries management.

However, care must be taken to ensure that while small vessels may have the protection of an exclusive 12-mile zone they must be part of the larger system of fisheries management even though territorially limited and protected, otherwise the sector will expand as a means of evading the general measures. That would serve neither the companies fishing in deeper water nor the inshore vessels.

It must, however, be stressed that should 12-mile limits continue, the management regimes operated within them must be consistent with the management system in any larger fishery of which they are part. They must not be allowed to become a means of avoiding capacity-controlling features of the fishery management systems in force outside the 12-mile limit.

Resolution of Conflicts of Activity

Conflicts of activity arise where incompatible fishing methods are used to prosecute a single fishery or where different fisheries requiring incompatible gear take place over the same ground, for example, where trawling takes place in an area also fished with static gear. Such conflicts can best be resolved through a market mechanism where one group purchases from others the exclusive right to the ground.

For instance, with an ITQ system if a management authority were to set aside certain geographical areas of the sea where the fishing method were to be prescribed or where some methods were prohibited those prevented from fishing by their chosen method would have the options of selling their quota, changing their fishing method, or moving elsewhere.

Alternatively, to resolve conflicts the market could be used to determine the method of fishing to be permitted if fishing companies were to be invited to tender for the right to fish a given area. The groups whose bid was the highest could then have the right to the ground for a given period and there would be funds available to compensate those prevented from fishing.

Sportfishing

Sportfishing, where the catch is not sold, is not normally significant as a proportion of the total landings and can safely be allowed to continue. However, there are two aspects which require consideration.

In some places sportfishing has developed into a significant leisure industry and some consideration may need to be given to imposing a management system if the sector becomes too large. Such a fishery would present some difficulty to managers though any of the systems applicable to commercial fisheries considered in the previous section might be used with effect. For example, private vessels could be managed by having to purchase one of a restricted variable number of licences bringing sea sportfisheries on a par with freshwater angling.

References

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VII SYNTHESIS AND CONCLUSIONS

From the systems set out in Section VI it is clear that though several systems are feasible only a few have enough of the desirable characteristics to be worth recommending.

There are many variations of the potential systems for fisheries management. This synthesis and conclusions should be read in the context of the systems as they are described in Section VI above.

We have tried to manage the difficulty of political acceptability and sustainability by suggesting that the status quo level of landings and activity be acknowledged and treated as a starting point. We feel this has more virtue than in trying to tighten systems when evasion is already widespread. It also has the benefit of reducing the threat felt by those in the industry that they will either be forced from the industry or compelled to cope with even more detailed regulation of their activity. Both sentiments we feel are behind some of the resistance to what many acknowledge are better systems than those in place at present.

Table 1 roughly summarises the advantages and shortcomings of a number of systems though the reader should beware that such a table can show only limited differences of degree. The criteria used for assessment should not be taken to be of equal importance, so that a column showing the most stars does not necessarily indicate the best system. The most important criteria and the preferred systems have been highlighted by bold type. In addition it must be assumed that enforcement is effective and that the scientific advice is adequate.

It should also be noted that eradicating the market failure is dependent on setting the correct level of TAC, quota fee, royalty, number of licences or so forth. The question is how to determine what is the long-run sustainable and economically efficient level of, say, TAC. Any error will be reflected in the development of the familiar problems of overcapacity and declining spawning stocks. However, an evolutionary approach towards the long-term sustainable level will generally succeed if slowly except perhaps with pelagic species.

All systems will benefit from good economic and scientific advice, and though some systems do not explicitly need a TAC, an estimate of the desirable level of landings will be necessary in order, for example, to calculate the amount of fishing activity that should be permitted or charge levied.

TABLE 1	State Monopsony	**Quota Fees**	**Tendered Quota**	Royalties	Individual Quotas	**ITQs**	RESQMS	**Seabed Plots**	Perpetual Licences	**Tendered Licences**	Tradeable Days at Sea	Input Taxes
Wide applicability	**	**	**	**	**	**	**		**	**	**	**
Amenable to co-management			*		**	**	**	**			**	
Assists enforcement		**	**		*	**	**	**	*	**	**	
Relative ease of enforcement	*							**	**	**	**	*
Administrative simplicity	*	**	*	**	*			**	**	**	*	**
No requirement for TACs	**			**				*	**	**	**	**
Relatively low management costs	*	*	*	*				**		**	*	*
Solves market failure	**	**	**	**		**	*	**		*		*
Does not create barrier to entry	**	**	**	**			*			**		**
Reduces discarding	*		?	*		?			**	**	**	**
Flexible approach for each fishery	**	**	**	**	*	**	**			*	*	
Political sustainability		*	**			**	*	**		*		
Proven effectiveness	*	**				**		**		*		

* partly satisfies criterion
** fully satisfies criterion

Table 1 does not cover all aspects of fisheries management. The free rider problem is a matter for the management structure to deal with by ensuring equitableness or, better, a common regime.

A management structure is most likely to be accepted if it incorporates co-management by fishing vessel operators.
Co-management is most relevant to those systems where property or harvesting rights exist as there is a greater incentive for vessel operators to maximise the long-run capital of their asset.

A strong case exists for a more integrated approach to fisheries management. In conformity with the principal of subsidiarity the management of fisheries should be left at the national or local level where possible. However, a systematic review of all European Union fisheries to indicate which could be managed by regional bodies representing the participating Member States would be desirable.

It would be possible to introduce some systems, such as royalties, quota fees, tendered quota, tradeable days at sea and tendered licences, in a pure form almost immediately. It should be noted that this is not the same as saying that the level of fishing should be reduced immediately to that required to achieve economic efficiency and long-term sustainability. The industry needs time to adjust and very few stocks appear to be in need of such instant action.

For others it might be desirable at the outset to develop a hybrid regime of management incorporating more than one system. Thus, for example, while a basic ITQ system might be introduced it would probably be supported for political reasons in the first instance by a licence system and perhaps also for enforcement reasons by a days-at-sea regime as has happened in the Dutch case. The supporting measures would be dropped as the basic system gained industry acceptance and proved its effectiveness. This should be viewed as a twenty year process. It will take that time for the stocks to respond, for existing distortions in the industry to be shaken out and for attitudes to adapt to the new low-cost structure of the industry.

Only state monopsony, royalties, tendered quota, quota fees, ITQs and seabed plots truly offer a solution to the market failure. Other systems have varying degrees of problem especially in failing to prevent the race to fish and capital stuffing.

Most significantly, while some systems are easier to enforce than others or offer some encouragement to compliance, none solves the enforcement problem. The CFP TAC and quota regime works in Holland where ITQs are applied (except that because of the international free rider problem nobody enjoys the benefits of the larger landings that should eventuate). It does not work elsewhere. This points to there being something in the ITQ regime that changes the attitude of the industry and encourages it to demand effective enforcement. The stimulant is a property right to fishing or of charges for fishing. Those who own fishing rights will not tolerate the presence of those who do not. Thus those systems which offer a property right or right of access which has a market value encourage compliance and effective enforcement.

Unfortunately the operation of the TAC and quota system within the Common Fisheries Policy has become a scapegoat for the widespread mis-management of fisheries by national administrations. Despite needing days-at-sea limitations to assist enforcement, if the Dutch ITQ system had been used by other Member States, many European fisheries would have been more successfully managed. This is not to say that it is the only system that would have worked or that it would have been applicable in every fishery. The Dutch seabed plot system has also succeeded though its applicability is obviously limited.

Tendered quotas appear to have most of the advantages of ITQs but fewer drawbacks. They fit European attitudes to common property better. They extract some of the economic rent for society, and they do not offer the competitive disadvantages to second generation purchasers of quota. On the other hand the absence of a windfall gain to those currently in the industry will make the system less attractive to them.

Not all the systems are consistent with the notion of free movement of capital set out in existing European Treaties. State monopsony runs counter to the philosophy of the free market. RESQs offer permanent restrictions on the free tradeability of fishing rights within the European Union but are supported to some extent by the spirit of the Union's regional policy. Similar considerations apply to the principle of relative stability and the issue of quota-hopping.

Royalties and input taxes may be politically untenable as they will all be viewed as unfair forms of taxation. These and quota fees would face continual political pressure for their reduction or scrapping which would be inclined to undo the desired correction of the market failure.

Individual quotas have little to recommend them over the existing system and in any case appear to tend towards ITQs.

RESQs are complex, may be too restrictive to allow a proper market for the quota to develop, and may fail as a result to completely overcome the market failure. In addition, they are untried.

Seabed plots are potentially very effective but of applicability only to coastal fisheries for sedentary shellfish.

Perpetual licencing and tradeable days at sea are unsustainable because capital stuffing leads to the need for continual reduction in the number of licences or days and ultimately lead to an excessive contraction and input distortions.

Tendered licences have the virtue of simplicity of administration once the initial definition of the licences has been made. They will, however, also result in input distortions, though not so severely as with perpetual licences. Nor will they end the race to the fish.

To correct the market failure, which must be the prime function of a management system, and given the other considerations outlined, leaves a choice to made between quota fees, tendered quota, royalties, ITQs, and tendered licences.

None of the systems is perfect. Each has a different set of advantages and disadvantages and the weight attributed to each of them is a matter for the political process. It is not possible, either, to offer a general answer as to which system will be most effective in managing fisheries. The appropriate system can only be decided by considering the characteristics of individual fisheries one by one. Different fisheries will be suited by different systems. Any redrawing of the Common Fisheries Policy must take this into account.

Conflicts of activity can be solved by designating certain areas for specific gears or fisheries and allowing the market to determine who has access to them.

Whichever system is chosen effective enforcement is a key requirement, and the system likely to perform best will partly depend upon the practicability and costs of enforcement. For instance, the apparent

success in the Dutch case of enforcement of the ITQ system has undoubtedly been facilitated by having relatively few ports. Ensuring compliance is always likely to be much harder in Mediterranean and other fisheries with a multitude of small vessels and ports, and perhaps a short distribution chain, where more easily enforceable systems such as tendered licences may be more appropriate.

The introduction of designated landings ports, or markets, could be expected to reduce enforcement costs, especially with quota-based management systems. Where deemed necessary, it could be the responsibility of groups such as POs or *Cofradias* to decide which ports or markets within their area should be designated to accept landings and also to provide fishery officers on a shared or dedicated basis to police the landings.

However, in order to discourage illicit landing and sale of fish, monitoring would still be needed of other potential points of landing or sale. Furthermore, in some cases the reduced enforcement costs entailed in introducing designated landings ports, or markets, may be outweighed by the economic inefficiency created by increased transport costs.

The main criterion used to judge the alternative management systems is the standard one of economic efficiency. However, in regions of high unemployment and few alternative work opportunities, some doubt remains as to whether these benefits predicted by the theory will in practice outweigh the transition costs. Providing there is no danger of stock collapse if the existing system continues, the costs associated with increases in unemployment and the multiplier effects within the local economies anticipated in changing management systems might be greater than the efficiency gains.

It should be noted, as the Icelandic experience with ITQs has demonstrated, that the overall impact on unemployment of changing management system is not necessarily detrimental even where reductions in overcapacity lead to fewer vessels in the fleet. This can be more than compensated for by improvements in catch quality, increases in onshore processing and marketing associated with more valuable total catches, as well as larger catches in the long term.

In theory it is primarily the allocation of harvesting rights through market mechanisms to fishing companies with the lowest harvesting costs which leads to economic efficiency. However, where there are variations between Member States in enforcement of fishing and safety regulations, fleet modernisation grants, and other operating conditions, fishing companies with the lowest costs are not necessarily the most efficient. This underpins the controversy surrounding quota-hoppers. Thus a management system based upon a market mechanism such as free trade in fishing rights between Member States can be distortive.

As in other industries, preventing low costs associated with economies of scale leading to monopolistic concentration of ownership of fishing rights can also provide a legitimate reason for imposing restrictions on the operation of market based management systems.

Under licencing, ITQs, RESQs, Days at sea and other systems involving allocation of property rights, the criteria used for making initial allocations is likely to be highly contentious. Anticipation of the likely basis to be used for initial allocations may lead to economic distortions due to strategic behaviour by vessel operators changing their fishing activity patterns in order to qualify for the best possible allocation.

It is clear that the presence of a TACs and quota system in the Common Fisheries Policy is not in itself undesirable since several effective management systems rely on a TAC.

However, it is widely acknowledged that there has been a general failure of the management regime and its enforcement. Further, the European Commission has failed to understand the causes of overfishing and economic inefficiency in the fishing industry. Thus, it is equally clear that the Common Fisheries Policy needs a complete overhaul to achieve the eradication of the market failure and effective compliance with whatever management systems are put in place.

It is likely that within the Common Fisheries Policy a range of technical measures in support of the management systems will continue to be needed. In addition, the period over which, say, a fishing right is to exist should be given close consideration to see if it can be phased to coincide with the behavioural characteristics of the stocks. The current calendar-year TACs are out of phase with some stocks.

The choice of management system to eradicate the market failure and achieve a stable, sustainable, and profitable fishery is particular to each. It is not possible to say that such and such a system is suitable for all. Detailed discussion is needed to define each fishery and to determine the most appropriate management system.

APPENDIX: LIST OF FISHERIES ECONOMICS RESEARCH AND OTHER ORGANISATIONS (dark shading indicates categorisation)

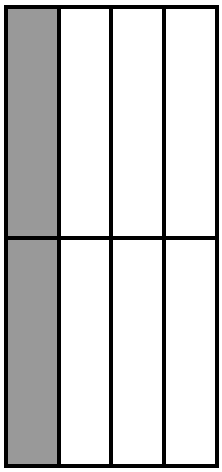
BELGIUM

GOVERNMENT	NON-GOVERNMENT	ACADEMIC	PRIVATE		ECONOMIC	SCIENTIFIC (BIOLOGICAL)	TECHNICAL (GEAR)
		■		Faculteit Van de Landbouwwetenschappen Laboratorium voor Aquacultuur en Artemia Center, Rozier 44 B-9000 Gent Phone: 32 9 264 3754 Fax: 32 9 264 4193		■	
				Fisheries Research Station- RZO Ankerstraat 1 B-8400 Oostende Phone: 32 59 320 388 Fax: 32 59 330 692		■	■
		■		Laboratorium Ecologie Aquaculture Zoölogisch Instituut Katholieke Universiteit Leuven Naamsestraat 59, B-3000 Leuven Phone: 32 16 283 966 Fax: 32 16 284 575		■	
■				Rijksstation voor Zeevisserij (RvZ) Ministéire van Landbouw Agricultural Research Centre, Ankerstraat 1, B-8400 Oostende Phone: 32 59 320 805 Fax: 32 59 330 629	■		

DENMARK

GOVERNMENT	NON-GOVERNMENT	ACADEMIC	PRIVATE		ECONOMIC	SCIENTIFIC (BIOLOGICAL)	TECHNICAL (GEAR)
		■		Danish Institute of Fisheries Economics Research (DIFER) South Jutland University Centre Niels Bohrs Vej 9, Esberg, 6700 Phone: 45 79 14 11 82 Fax: 45 79 14 11 99	■	■	
	■			Danish Institute for Fisheries Techology and Aquaculture (DIFTA) The North Sea Centre, Box 93 Hirtshals, DK-9859 Phone: 45 98 94 43 00 Fax: 45 98 94 22 26	■	■	■
■				Danish Institute for Fisheries Research Charlottenlund Castle DK- 2920 Charlottenlund Phone: 45 33 96 30 00 Fax: 45 33 96 33 33		■	
■				Danmarks Tekniske Hojskole Fiskeriministeriests Forsogslaboratorium (FF) Bygn 221, DK-2800 Lyngby Phone: 45 42 88 33 22 Fax: 45 42 88 47 74		■	
			■	Institute for Fisheries Management & Coastal Community Development (IFM) The North Sea Centre Hirtshals, DK-9850 Phone: 45 98 942855 Fax: 45 98 944833	■		

GOVERNMENT	NON-GOVERNMENT	ACADEMIC	PRIVATE		ECONOMIC	SCIENTIFIC (BIOLOGICAL)	TECHNICAL (GEAR)
		■		Ministry of Agriculture and Fisheries Slotsholmsgade 12 DK-1216 Copenhagen Phone: 45 22 92 33 01 Fax: 45 33 14 50 42		■	
		■		North Atlantic Regional Studies Centre Roskilde University PO Box 260, DK-4000 Roskilde Phone: 45 46 75 77 11 Fax: 45 46 75 42 40	■		
		■		Biologisk Institut Odense University Campusvej 55, DK-5230 Odense Phone: 45 66 15 86 00 Fax: 45 65 93 04 57		■	



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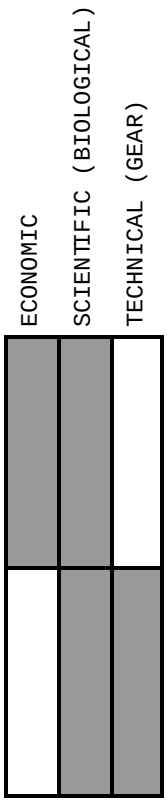
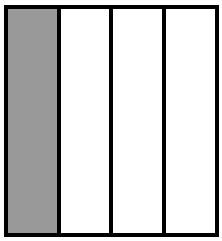


FRANCE

GOVERNMENT	NON-GOVERNMENT	ACADEMIC	PRIVATE		ECONOMIC	SCIENTIFIC (BIOLOGICAL)	TECHNICAL (GEAR)
		■		C3E - Littoral Faculté des Sciences Economiques 110 Bd. Michelet 44071 Nantes Cedex 03 Phone: 33 40 37 88 21 Fax: 33 40 37 88 05	■		
		■		ENSAR Unité Halieutique 65, rue de Saint-Brieuc F-35042 Rennes Cedex Phone: 33 99 28 75 30 Fax: 33 99 28 75 35	■	■	
■				Institut Francais de Recherche pour la Explotation de la mer (IFREMER) 155m, JJ Rousseau 92138 Issy les Moulineaux Cedex Phone: 33 1 46 48 21 00 Fax: 33 1 46 48 22 76	■	■	■
■				Ministery of Fisheries Agriculture and Food 3, Place de Fontenoy 75700 Paris Phone: 33 1 44 49 84 38 Fax: 33 1 44 49 84 00	■	■	
■				Laboratoire HEA Centre ORSTROM, BP 5045 911 Ave Agropolis 34032 Montpellier Cedex Phone: 33 67 61 74 36	■	■	
		■		University of Montpellier Place E. Bataillon F-34060 Montpellier Cedex 5 Phone: 33 67 14 37 52 Fax: 33 67 14 30 31	■		

GERMANY

GOVERNMENT	NON-GOVERNMENT	ACADEMIC	PRIVATE		ECONOMIC	SCIENTIFIC (BIOLOGICAL)	TECHNICAL (GEAR)
■				Bundesforschungsanstalt für Fischerei Palmaille 9 D-22797 Hamburg Phone: 49 40 3890 5120 Fax: 49 40 3890 5120		■	■
■				Institut f. Fischereiöcologie BFA f. Fischerei Deichstrasse 12 27472 Cuxhaven		■	
■				Institut für Ostseeforschung Seestrasse 15 18119 Warnemünde		■	
■				Federal Agricultural Research Centre Braunschweig-Völkenrode (FAL) Institute of Agricultural Market Research, Bundesallee 50, D-38116 Braunschweig Phone: 531 596 577 Fax: 531 596 367		■	



GREECE

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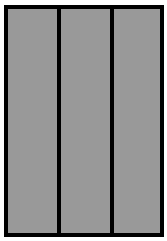
Fax: 30 1 323 1082

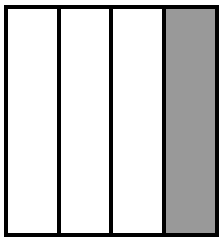


IRELAND

GOVERNMENT	NON-GOVERNMENT	ACADEMIC	PRIVATE		ECONOMIC	SCIENTIFIC (BIOLOGICAL)	TECHNICAL (GEAR)
			■	Economic and Social Research Institute 4 Burlington Road Dublin 4C Phone: 353 1 676 0115 Fax: 353 1 668 6231	■		
■				Fisheries Research Centre Abbotstown, Castleknock Dublin 15 Phone: 353 1 821 0111 Fax: 353 1 820 5078	■	■	■
	■			Planning and Market Research Executive, Irish Sea Fisheries Board P.O. Box 12, Crofton Road, Dun Laoghaire, Co. Dublin. Phone: 353 1 284 1544 Fax: 353 1 284 1123	■		

ITALY

GOVERNMENT	NON-GOVERNMENT	ACADEMIC	PRIVATE		ECONOMIC	SCIENTIFIC (BIOLOGICAL)	TECHNICAL (GEAR)
		■		Istituto di Tecnologia della Pesca e del Pescato Consiglio Nazionale delle Ricerche (CNR), Via L. Vaccara 61 I-91026 Mazara del Vallo (TP) Phone: 0923 948723 Fax: 0923 906634			
■				Istituto di Ricerche sulla Pesca Marittima (IRPEM) Consiglio Nazionale delle Ricerche Molo Mandracchio, I-60100 Ancona Phone: 39 71 20 41 97 Fax: 39 71 55 313	■	■	■
		■		Istituto Idrobiologia e Acquacoltura “G. Brunelli”, Casali di Paola I-04016 Sabaudia (LT) Phone: 39 73 596 703 Fax: 39 63 217 582		■	
			■	Istituto Ricerche Economiche per la Pesca e’Acquacoltura (IREPA) Via Benedetto Croce, 35 I-84100 Salerno Phone: 39 89 24 15 03 Fax: 39 89 24 11 45	■		
			■	Laboratorio Centrale di Idrobiologia Ministero dell’Agricoltura e dell Foreste, Viale del Caravaggio, 107 I-00147 Roma Phone: 39 06 51 40 296	■		



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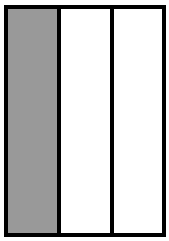
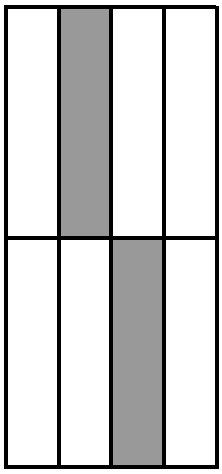


NETHERLANDS

GOVERNMENT	NON-GOVERNMENT	ACADEMIC	PRIVATE		ECONOMIC	SCIENTIFIC (BIOLOGICAL)	TECHNICAL (GEAR)
■	■			Agricultural Economics Research Institute (LEI-DLO) Burgemeester Patijnlaan 19, P.O. Box 29703, NL-2502 LS The Hague Phone: 31 70 33 08 330 Fax: 31 70 36 15 624	■		
		■		Department of Fish Culture and Fisheries Wageningen Agricultural University Postbus 338, 6700 AH Wageningen Phone: 31 83 70 83 307 Fax: 31 83 70 83 962	■		
■				Directorate of Fisheries P.O. Box 20401 2500 Ex The Hague			
■				National Institute for Coastal and Marine Managment / RIKZ P.O. Box 20907 2500 Ex The Hague		■	
■				Nederlands Instituut voor Oecologisch Onderzoek, Centrum voor Esturiene en Mariene Oecologie Vierstraat 28, 4401 EA Yerseke Phone 31 1131 1920 Fax: 31 1131 3616		■	

GOVERNMENT	NON-GOVERNMENT	ACADEMIC	PRIVATE		ECONOMIC	SCIENTIFIC (BIOLOGICAL)	TECHNICAL (GEAR)
■	■			Netherlands Institute for Fisheries Research- RIVO P.O. Box 68 1970 AB Ijmuiden Phone: 31 2550 64601		■	■
■	■			Netherlands Institute for Sea Resarch P.O. Box 59 1790 Den Burg, Texel		■	



PORTUGAL

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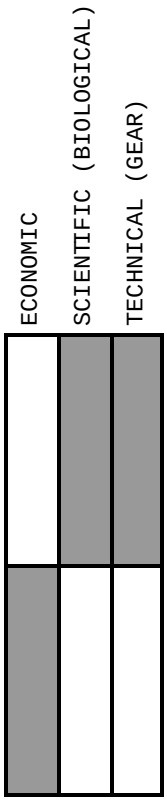

SPAIN

GOVERNMENT	NON-GOVERNMENT	ACADEMIC	PRIVATE	
		■		Gabinette de Economia del Mar Facultat d'Economiques University of Barcelona Avd. Diagonal, 690 Barcelona 08034 Phone: 34 3 42 85 277 Fax: 34 3 21 78 734
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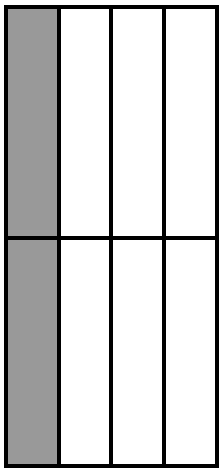
ECONOMIC	SCIENTIFIC (BIOLOGICAL)	TECHNICAL (GEAR)
■		
	■	■

SWEDEN



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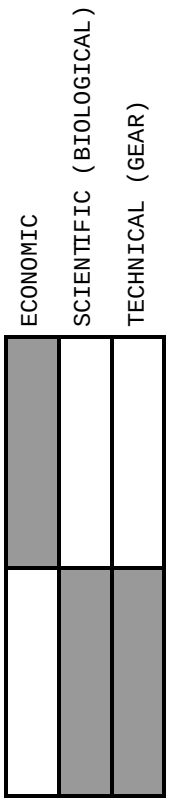

UNITED KINGDOM

GOVERNMENT	NON-GOVERNMENT	ACADEMIC	PRIVATE		ECONOMIC	SCIENTIFIC (BIOLOGICAL)	TECHNICAL (GEAR)
		■		Centre for Marine Resource Economics (CEMARE), University of Portsmouth Locksway Road, Milton, Portsmouth PO4 8JF Phone: 44 1705 876 543 Fax: 44 1705 844 037	■		
■				Fisheries Laboratory Directorate of Fisheries Research Lowestoft, Suffolk NR33 OHT Phone: 44 1502 562 244 Fax: 44 1502 513 865		■	■
		■		Hull International Fisheries Institute, University of Hull The Wolfson Building Cottingham Road, Hull HU6 7RX Phone: 44 1482 466 421 Fax: 44 1482 470 129	■	■	
		■		Institute of Aquaculture University of Stirling Stirling Scotland FK9 4LA Phone: 44 1786 467 889 Fax: 44 1786 451 462	■	■	
■				Marine Laboratory Scotish Office Agriculture, Environment and Fisheries Department, Victoria Road Aberdeen AB9 8DB Phone: 44 12 24 876 544 Fax: 44 12 24 295 511	■	■	■

GOVERNMENT	NON-GOVERNMENT	ACADEMIC	PRIVATE		ECONOMIC	SCIENTIFIC (BIOLOGICAL)	TECHNICAL (GEAR)
■				Ministry of Agriculture, Fisheries and Food (MAFF) Whitehall Place West London SW1A 2HH Phone: 44 171 270 8737 Fax: 44 171 270 8558		■	■
	■			Sea Fish Industry Authority 18 Logie Mill, Logie Green Road Edinburgh EH7 4HG Phone: 44 131 558 3331 Fax: 44 131 558 1442	■	■	■

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