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FISHING ASPIRATIONS & FISHING CAPACITY

Two Key Management Issues

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1 Introduction

Globally, the apparent demand for fish is increasing faster than the world's population. Given that commercial fish stocks within EEZs are generally fully exploited, it is natural that a growing share of fishing aspirations – of both operating and prospective fishers – are being directed towards fisheries on the high seas. As a result there is an urgent need to assure the effective management of high seas fisheries.

Until now, those confronted with the need to management fishing capacity have been primarily focusing their attention on the management of capture fisheries within EEZs. This is the consequence of both the magnitude of the problem in EEZs and the limitations of the means available for dealing with it. Within EEZs, fishery managers already have the opportunity to remedy the deficiencies caused by the open access nature of the fisheries. This is not the case yet on the high seas.

This paper explores a variety of topics related to fishing aspirations and capacity management. It discusses fishing aspirations, looks at the suite of existing established capacity management measures and their technical applicability to the high seas situation, and examines some of the challenges and opportunities for addressing capacity management and fishing aspirations in high seas fisheries.

The paper tries to identify possible options for management of fishing capacity in high seas fisheries. It does not take the step that logically will follow once options have been identified. It does not appraise the feasibility of using these various options. Therefore, naturally, the paper is not advocating any, or all of them.

2 Managing fishing aspirations and, hence, capacity

Fishing aspirations can be defined as the desire to be able to go fishing, to make money, and to provide fish. This is a desire that is common to fishers the world over.

For the purpose of this paper, it is useful to consider two types of fishing aspirations. On the one hand, these aspirations may reflect the desire to continue to fish and to exercise rights already acquired. On the other hand, fishing aspirations can be thought of as the desire to acquire both the means and rights to go fishing.

2.1 Governmental fishing aspirations

Governments generally do not harbor fishing aspirations *per se* in the commercial sense, but they do try to create and maintain the opportunity for individual fishers and enterprises active in their countries to act out their entrepreneurial fishing aspirations. Indeed, it is for this reason that countries, or groups of countries, are motivated to negotiate fishing access agreements. To date, such agreements have typically addressed access to the harvesting of transboundary stocks, although some have contained provisions for high migratory and/or straddling fishing stocks.

At present no United Nations (UN) or other international body has the authority to somehow “manage” these governmental fishing aspirations. Nevertheless a number of international instruments - some binding (for those nations that have signed them) and others voluntary in nature - provide quite clear guidance on the criteria that nations ought to impose on themselves when considering whether or not to authorize high seas fishing by fishers and enterprises that are subject to their jurisdiction.

2.2 Fishing aspirations of fishers and enterprises

Governments usually determine who amongst their respective nationals can enjoy and act out their aspiration to fish and to try to earn a livelihood from fishing. Therefore, in most countries it is recognized that Governments have the power to prohibit nationals from fishing - not only in EEZs, but also on the high seas – and when taking such decisions governments will generally consider:

- the sustainability and viability of the fishery (or fisheries) in question – in both biological and economic terms - for current *and* future exploitation; and
- access to the fishery (or fisheries) – so that the management of the fishery is sufficiently accepted by and desirable to participants to inspire them to legally utilize the resource(s), both at present and in the future.

There is a clear link between fishing aspirations and fishing capacity. Indeed, if there were no aspirations to fish, there would be no fishing capacity, no problems caused by overcapacity, or need for capacity management. This means, of course, that if the “aspiration to fish” is extinguished the (over)capacity problem is also eliminated. This would seem to be particularly important to remember for the management of fishing capacity on the high seas, where any control of fishing capacity and compliance with capacity management measures may be problematic, if only because of the enormous geographical scale of fishing operations.

Fishing aspirations, particularly in difficult environments such as those found on the high seas, tend to be financially motivated. Thus, in theory the management of these fishing aspirations could make use of economic instruments such as taxes (when the purpose is to reduce activities), subsidies (when the purpose is to increase the level of activities), or trade measures. These economic instruments could be applied “up-stream” - that is, to goods and services that are needed by those who undertake high seas fisheries. Vessels, gear and fuel are of primary importance as are land-based services for vessels, their crew and catches. Economic instruments can also be applied “down-stream” - that is, to the fish and fish products derived from high seas fisheries.

Today high seas fisheries are international in nature. Both the goods and services needed by the industry (inputs) and the final products (outputs) are traded internationally. This means that in a large number of countries - including countries whose fishers and enterprises are not participating in high seas fisheries - civil society pressure groups as well as governments can take action that help or hinder the high seas fishing industry.

3 Managing fishing capacity and, hence, shaping aspirations

The purpose of managing fishing capacity is to ensure that fishing capacity is used in such a way that fisheries remain sustainable and viable. Alternatively, the purpose of capacity management is to avoid the appearance of overcapacity or, where overcapacity already exists, to reduce and prevent the subsequent buildup of overcapacity.

In the absence of measures to correct market failures, many efforts to manage capacity rely on limiting access to fisheries. Because of this, and in addition to considering sustainability and economic viability issues, governments need to consider how to accommodate new entrants.

3.1 Capacity management: ensuring sustainability and viability

Efforts to limit catches – limits that are needed to keep catches sustainable and viable - are only feasible if the participants in the fishery actively support such constraints. And, for participants in a fishery to want to support constraints on their harvesting activities, the benefits of participating under limited catch schemes must be commercially viable. After all, fishing is a business, and the individuals engaging in fishing want to be successful and to be sure to benefit from their activities. Thus, viability becomes a function of the choice of management program, and sustainability becomes a function of how the management program motivates participants to uphold catch limits whilst still being profitable.

In addition to having to inspire participation in the management program for a fishery, those who are not participants need to be motivated to want to participate. Hence, a key design element of acceptable participation schemes is to set up management arrangements that encourage participation without disadvantaging existing participants *and* that inspire new entrants to participate instead of simply circumventing the management system.

Another approach to inspiring commercial compliance with sustainability initiatives is to make noncompliance and circumvention undesirable. Such approaches may include the use of so-called black lists and white lists as well as the introduction of measures that allow participants in sustainable fisheries to demonstrate and benefit from providing sustainably harvested product.

3.2 Capacity management: accommodating new entrants

New entrants can readily create negative externalities for those already participating in a fishery in terms of their additional impacts – both on the fish stocks and on the economic health of the fishery.

If there are no mechanisms that enable commercially profitable sharing within a fishery, it is understandable that fishers will simply ignore management efforts to limit catches and circumvent the management process, thereby undermining the viability of the fishery.

Thus, one key element to making participation desirable is to have mechanisms for reallocating shares of a fishery. Indeed, this would seem to be particularly important for high seas fisheries, where participants may believe - rightly or wrongly - that the benefits to obtain from entering high seas fisheries are large whilst the penalties are insignificant.

3.3 The causes and impacts of overcapacity

To manage capacity, it is useful to understand why overcapacity arises in the first place.

Overcapacity in fisheries develops primarily as a consequence of the absence of clearly defined property rights and the way in which fishers react to the influences or incentives that they face under such conditions. FAO, 2004b

In addition to being the primary reason for overfishing in domestic and global fisheries, overcapacity leads to several problems, including:

- overinvestment in capital and the excessive employment of labor in the harvesting industry with impact on processing in some cases;
- depleted abundance for both the directed fishery and associated fish stocks; overfishing and, potentially, denigration of habitat;
- reduced returns to capital and labor, and a decline in the quality of life of fishers and their families; and
- increasing political strife in the management process.

While political strife may develop as a result of attempting to redress the overcapacity problem, political strife in the management process can also develop as a direct consequence of overcapacity in a fishery... [a]s fishery resources become increasingly depleted or as total allowable catch is reduced by management regulations... FAO, 2004b

In contrast, correct levels of capacity ensure greater stock diversity, lower production costs, and increased social benefits from improved ecosystems.

Thus, the intention of capacity management is to identify the desired level of capacity and to either prevent the development of overcapacity or to bring the existing capacity into line with the predefined target level of capacity.¹

3.4 The technical tools for managing capacity²

The ability to accommodate both capacity concerns and fishing aspirations will be determined by the type of management strategies that the fisheries community agrees to implement. There are two categories of technical tools for managing fishing capacity: those that work by blocking the incentives for fishing and those that adjust and changes the incentives (FAO, 2002).

Under incentive blocking approaches, participants are not motivated to work to minimize their costs to maximize profits. Based on tools (input controls) that attempt to block the economic drivers that motivate fishers to increase their fishing capacity, fishers work to maximize their current revenues via catch quantities (and not necessarily price for that catch) at whatever cost it takes. As a result, the fishers have every reason to overcapitalise and overinvest as the primary means for ensuring that they catch more fish and generate more revenues than their competitors.

¹ This target level of capacity relates to some desired stock size and level of exploitation of the stock, so there is also an implicit (or, in some cases, explicit) target fishing mortality and stock level.

² These tools are described in more depth, along with the advantages, shortcomings, and implications of each in *Appendix B: Technical tools for capacity management*.

This strategy may be successful if resources are unlimited, but in capture fisheries where the sustainable amount of fish can be caught is finite, it is a recipe for commercial waste (via excessively high production costs), escalating management and enforcement costs of capacity containment efforts, and resource disaster (via overfishing).

Measures in this category include:

- limited entry programs, permit moratoria, license limitation programs
- buyback programs,
- gear and vessel restrictions,
- total allowable catches (TACs),
- vessel catch limits, and
- individual effort quotas (IEQs).

The problem with these measures is that they do not prevent the formation of overcapacity. Indeed, these controls actually create long run incentives for capacity to increase rather than decrease.³

Incentive blocking programmes are only effective in reducing capacity in the short term. FAO, 2004b

The purpose of incentive adjusting approaches is to transform the process of competitive hunting into one of conscientious production where profit maximization of a limited resource occurs through cost minimization. Based on user rights, they create forces to drive structural adjustment within a fishery and the reduction of overcapacity whilst accommodating the entrepreneurial opportunity to be commercially profitable. These systems transform the stock(s) in question into a shared asset that inspires and warrants cooperative behavior to conserve and enhance the value of the asset. Thus, sustainability and commercial concerns are aligned and even reinforce each other.

Nonetheless, and despite the acknowledged failure of top-down command and control management systems in many sectors of the economy, there are political and social concerns about using rights-based incentive aligning management programs in the fisheries sector. Uncomfortable as this is, these approaches offer the only durable, automatic, and self-adjusting management tools for addressing overcapacity. Measures in this category include:

- "group" fishing rights including community development quotas (CDQs), cooperative fishing rights, community-based management user rights,
- area or region-based Territorial Use Rights (TURFs); or
- individual fishing quotas (IFQs) and individual transferable quotas (ITQs).

³ In such cases, the only option is then to implement costly, explicit and ongoing capacity management – such as limited access plus recurring buyouts - as part of the overall management system.

Table 1. Fisheries management tools: duration and effect(s) on overcapacity

Management Approach	Management Tool	Duration	Effects	
			Direct Effect(s)	Longer-term Effect(s)
Incentive Blocking Approaches	limited entry programs	temporary	<ul style="list-style-type: none"> limit participation 	<ul style="list-style-type: none"> capital stuffing – where a vessel’s horsepower, length, breadth, and tonnage are increased – typically occurs drives changes (technological innovations) in gear, in fishing periods or areas create motives for IUU fishing capacity will increase
	buyback programs	temporary	<ul style="list-style-type: none"> purchase of vessel(s), license(s), and/or gear(s) capacity <i>may</i> be temporarily reduced in the fishery 	<ul style="list-style-type: none"> any improvements in stock abundance will attract additional capacity create motives for IUU fishing capacity will increase
	gear restrictions vessel restrictions	temporary	<ul style="list-style-type: none"> initial reduction in harvests 	<ul style="list-style-type: none"> substitution of unregulated inputs or new gear types to replace restricted inputs regulations lose effectiveness and additional regulations required create motives for IUU fishing capacity will increase
	aggregate quotas total allowable catches (TACs)	temporary	<ul style="list-style-type: none"> likely to accelerate the growth of fishing capacity rather than reduce it 	<ul style="list-style-type: none"> capacity and effort increase if effort and entry unrestricted race for fish (“fishing derby”) develops create motives for IUU fishing: additional regulations required, particularly to limit discarding and false reporting, ensure traceability and to control transshipment potential for frequent overruns of the TAC resulting in overexploitation frequently result in excess processing capacity and processing plant down time during closed season(s) capacity will increase
	non-transferable vessel catch limits (individual quotas / IQs)	temporary	<ul style="list-style-type: none"> overcapacity not addressed may limit additional growth of capacity 	<ul style="list-style-type: none"> requires regulations to ensure traceability and to control transshipment additional regulations required create motives for IUU fishing capacity will increase
	individual effort quotas (IEQs) denominated in trawl time, gear use, time away from port, fishing days, etc.	mid-term	<ul style="list-style-type: none"> enforcement difficult additional regulations required to control input substitution 	<ul style="list-style-type: none"> capital stuffing – where a vessel’s horsepower, length, breadth, and tonnage are increased – frequently occurs requires regulations to ensure traceability and to control transshipment create motives for IUU fishing capacity will increase
Incentive Adjusting Approaches	group fishing rights: community development quotas (CDQs), community-based management	potentially enduring	<ul style="list-style-type: none"> reallocation of the fishery to the recipient community 	<ul style="list-style-type: none"> requires group understanding of asset value of user rights, capability to manage reduction of overcapacity or capacity containment depends on subsequent management
	territorial use rights (TURFs)	potentially enduring	<ul style="list-style-type: none"> reallocation of the fishery to the recipient community 	<ul style="list-style-type: none"> requires group understanding of asset value of user rights, capability to manage reduction of overcapacity or containment of capacity linked to subsequent management
	taxes and royalties	indefinite duration	<ul style="list-style-type: none"> market forces drive out overcapacity consolidation if overcapitalized 	<ul style="list-style-type: none"> administratively intensive: require constant adjustment of tax levels to maintain capacity at desired level politically difficult to impose, easier to rescind
	individual transferable quotas (ITQs), individual fishing rights (IFQs)	enduring	<ul style="list-style-type: none"> market forces drive out overcapacity consolidation occurs if overcapitalized 	<ul style="list-style-type: none"> capacity managed automatically, overcapacity does not occur / recur compliance concerns internalized by fishers to protect asset (rally against IUU fishing) supplementary regulations helpful to reinforce conservation

3.5 Managing fishing capacity: the high seas case

The crux of the high seas overcapacity problem is the prevalence of open access conditions and the absence of operational management schemes for discrete high seas stocks. In addition, there is no single international source of authority; rather, there are various sources of authority which are sometimes both international and national in nature.

There would seem to be two types of approaches to solve this issue. The first approach would be to obtain international agreement on particular capacity management measures. And, indeed, international agreement on such sorts of international management measures has already been achieved. The UN General Assembly resolution to ban drift-netting on the high seas is an example, and the recent move to ban trawling on high sea sea-mounts also falls in this category.

The other approach would be to eliminate open access nature of fisheries in the high seas or, at least, of particular high seas fisheries, through a binding universal international agreement or similar instrument. Attempts have been made mainly through regional fishery bodies and international instruments under UNCLOS⁴. Where open access is abolished, management could be achieved by use of the regulatory tools described above. However, progress is slow as this approach requires overarching enabling and empowering legal instrument(s), empowered fishing management organizations, organizational capacity to design and introduce capacity management measures; and political will and support for the implementation of such measures.

3.5.1 Limiting open access: enabling and empowering legal instruments

Potentially enabling and empowering legal instruments for limit access to discrete high seas fisheries already exist. Discrete high seas fish stocks are formally covered by the 1982 UN Convention in Articles 116(a), 116 (c) and 117 – 120, where States are urged to cooperate for the purposes of conservation.

The 1995 UN Fish Stocks Agreement⁵ (UNFSA) provides the essential governance framework for “coastal States and States fishing on the high seas” (Article 5). The various Articles provide the broad language for shaping more specific rules for participation; management; allocation – including the use of rights-based approaches (Article 10(b); exit / entry concerns; as well as the social issues of development that should be considered (Part VII). In addition, it provides for the establishment of RFMOs in areas where none exist (UN A/59/298, paragraph 35). Finally, the UNFSA can also be considered to address discrete high seas stocks under Part V. Duties of the Flag State.

The 1993 FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (Compliance Agreement), although not adopted by many States, provides additional useful support.

3.5.2 Empowering organizations: scope and management mandate

Increasingly, although not necessarily actually mandated, RFMOs and other bodies are being recognized as the vehicles for cooperative management efforts.

One such example is the South East Atlantic Fisheries Organization (SEAFO). SEAFO is empowered to formulate and adopt conservation and management measures (Article 6 paragraph 3(b)) and to determine the nature and extent of participation in fishing (Article 6 paragraph 3(d)). In addition, the Convention the South-East Atlantic Fisheries Organization already implements the UNFSA for all stocks on the high seas and is not limited to straddling and highly migratory fish stocks (FAO, 2004, p. 4).

⁴ The full title of UNCLOS is: United Nations Convention on the Law of the Sea of 10 December 1982.

⁵ The full title of the Agreement is: 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.

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Appendix A. Fish harvesting capacity: definitions and perspectives

Fish harvesting capacity concepts are not as clearly understood as other fisheries management concepts, such as overfishing. A main factor contributing to the confusion about capacity in fisheries is that different groups of people may have a different intuitive understanding of capacity.

The initiative to monitor and manage capacity instigated by the FAO through the International Plan of Action (IPOA) has also resulted in some confusion regarding definitions of key terms (if only because “capacity” is not defined in the IPOA). Thus, it is also important to distinguish between the concepts of capacity utilization, excess capacity, overcapitalization and overcapacity.⁶

To capture these different views of fishing capacity, FAO developed a definition of fishing capacity that was both input (e.g. effort, boat numbers, etc) and output (catch) based:

Fishing capacity [is] the amount of fish (or fishing effort) that can be produced over a period of time (e.g. a year or a fishing season) by a vessel or a fleet if fully utilized⁷ and for a given resource condition. FAO, 1998

Overcapacity can be considered the generic term for excessive levels of capacity in the longer term and relates to some long-term desirable level of capacity (the target capacity). This may be either some long-term target sustainable yield, or some long-term target level of capital employed in the fishery.

The term “overcapacity” conveys the fact that fishing capacity is greater than some desirable level of fishing capacity (the target capacity). FAO, 2004c

It is quite possible for overcapacity to exist - even in the absence of excess capacity. For example, in a fleet where all boats are assumed to be fully utilized, if stock biomass (rather than effort) is causing the lower levels of output there may be no apparent excess capacity, although the fishery is considerably overcapitalized, and hence overcapacity exists.

It is also possible to have both excess capacity and overcapacity - even when the maximum sustainable yield is being achieved. If a fleet subject to an effort quota (e.g. days at sea restriction) prevents each boat from being fully utilized, it is possible to achieve MSY even though the fleet is capable of producing considerably greater levels of effort. Indeed, the fleet could catch substantially higher catches in the short term if not restricted, even though the long term sustainable catch at that fleet size would be considerably lower.

Reduced stock biomass, low yields and unprofitable fleets are not in themselves problems for managers of a fishery if the objective of fisheries management is to maintain or increase employment; in such cases, these “problems” are just consequences of achieving this objective. However, when reduced stock size is incompatible with the complete set of management objectives, overcapacity exists, and managers need to address the problem.

Excess capacity exists when the potential catch or effort level exceeds the actual catch or effort level in a given period. It manifests itself in terms of capacity underutilization, and the existence of capacity underutilization implies the existence of excess capacity. Excess capacity is primarily a short-term phenomenon that can arise for a number of reasons. For example, lower prices or temporarily higher costs (e.g. fuel price increases) may result in boats operating on average for fewer days than

⁶ Indeed, the traditional economics literature on production does not make a clear distinction between excess capacity and overcapacity, and, in fact, these terms are often used as synonyms. Similarly, much of the theoretical discussion of fish harvesting capacity does not make a clear distinction between excess capacity and overcapacity in fisheries.

⁷ In this context ‘full utilization’ means normal but unrestricted use, rather than some physical or engineering maximum.

expected under more average conditions. Assuming the prices and costs return to normal levels in the future, then this form of excess capacity will be self correcting.

Excess capacity can also be caused by management. For example, stock recovery programmes may impose restrictions on catch or effort that results in the vessels being underutilized during the recovery process, but allows the vessels to be fully utilized when the stocks have increased. In such circumstances, the existence of excess capacity would not be considered problematic. Excess capacity can also indicate, however, longer term problems in the fishery. If restrictions are imposed that limit catch or effort and these restrictions are likely to persist into the future, then it is likely that excess capacity is an indicator of overcapitalization in the fishery.

Overcapitalization is the longer-term problem for the fishery. In its simplest form, overcapitalization can be considered to exist if the fleet size is greater than that required to harvest a particular yield (which in many cases may be greater than the current yield).

There is waste in terms of both the use of the resource and the benefits that may be generated from the fishing activity because the additional capital, labor and fuel used in maintaining the overcapitalized fleet not only reduces the potential revenue that could be realized from the fishery, but also costs more to harvest the lower level of fish than is necessary.

Greater catches (and revenue) could be obtained at lower total cost. The cost savings and potentially higher revenues generated with smaller fleet sizes could generate economic profits that can be used for the general benefit of the fishing communities or society as a whole.

Capacity utilization represents the degree to which the vessel is fully utilized. From an input based perspective, this may relate to the ratio of the number of days actually fished to the number of days the boat could potentially fish under normal working conditions. From an output based perspective, capacity utilization is the ratio of the actual catch to the potential catch (if fully utilized).

Box 1. Different perspectives of capacity

Fishing technologists often refer to capacity in terms of the technological and practical feasibility for a vessel to achieve a certain level of activity, be it days fishing, catch or processed product.

Fisheries scientists often think of capacity in terms of fishing effort, and the resultant rate of fishing mortality (the proportion of the fish stock killed through fishing). Effort is itself a fairly abstract concept, as in theory it encapsulates all inputs employed in the harvesting process.

In practice, it is generally not possible to measure all inputs, so proxy measures (indicators) are used such as total days fished, number of pots deployed or kilometers of nets used. A relationship between the measure of effort and fishing mortality is assumed to exist. If total fishing mortality exceeds the desired target level (generally a biological reference point relating to maximum sustainable yield or some other precautionary reference point), the fishing mortality rate is too high because fishers have produced too much fishing effort. If regulations can be imposed to ensure that effort levels are in line with target fishing mortality rates, then capacity is not considered an issue and the fact that fleet size may be larger than required is somewhat ignored.

Fisheries managers generally have a similar view of capacity, but often link this more directly to the number of vessels operating in the fishery. To many fisheries managers, capacity may be expressed in measures such as gross tonnage, for example, or in terms of total effort (e.g. standard fishing days). Assuming that there are no restrictions on effort, these measures may indicate that too many boats may potentially produce too high a catch, so overcapacity may be considered to exist if the fleet is larger than desired. Technically, there is a link between existing and target levels of effort and fleet size, but it a weak link.

Fisheries managers may also be concerned with the rate of vessel utilization. Underutilized capacity may manifest itself as boats fishing less than their expected "normal" number of days (full use), and thereby catching less than their potential.

Economists tend to consider capacity as some level of potential output that could be produced if the boat was operating at maximum profits. Operating at less than full capacity implies, therefore, that boats are not achieving their maximum profits, and that profits could be increased through increasing their output. In the short term, when stock sizes are given, profit maximization implies the full use of the vessels, which requires the application of a target nominal level of fishing effort (e.g. days fished) to achieve a target catch level.

Appendix B. Technical tools for capacity management

Because the approaches to capacity management and/or capacity reduction will have a profound influence on the way in which participants may engage in and conduct their fishing operations, it is important to understand the existing options for capacity management and how these drive fishing behavior.

The tools for managing fishing capacity fall into two categories: incentive blocking measures and incentive adjusting (aligning) measures (FAO 1998).

1 Incentive blocking measures

Incentive blocking measures attempt to block the economic incentives (motives) that drive fishers to increase their fishing capacity. They are short run solutions that restrain harvesting capacity by briefly stopping or slowing its growth rate, but they do not change the market incentives that cause long run overcapacity.

Under incentive blocking programs, participants are not motivated to work to minimize their costs to maximize profits. Instead, fishers work to maximize their current revenues via catch quantities (and not necessarily price for that catch) at whatever cost it takes. As a result, the fishers have every reason to overcapitalize and overinvest as the primary means for ensuring that they catch more fish and generate more revenues than their competitors. This strategy may be successful if resources are unlimited, but in capture fisheries where the sustainable amount of fish can be caught is finite, it is a recipe for commercial waste (via excessively high production costs), escalating management and enforcement costs of capacity containment efforts, and resource disaster (via overfishing).

Measures in this category include:

- limited entry programs, permit moratoria, license limitation programs
- buyback programs,
- gear and vessel restrictions,
- total allowable catches (TACs),
- vessel catch limits, and
- individual effort quotas (IEQs).

The problem with these measures is that it is both possible and reasonable to expect that when one input is reduced, others are substituted to offset the impacts of the capacity reduction efforts.

Incentive blocking programmes are only effective in reducing capacity in the short term. FAO, 2004b

As has become clearer and clearer with time, compliance is a very significant problem with incentive blocking measures to control capacity. If fishing firms are prevented from maximizing profits for its scale of production by a fishery management regulation, then there are incentives to circumvent the regulations, and large penalties and extensive enforcement are insufficient disincentives.

To date, and despite the acknowledged failure of top-down command and control management systems in many sectors of the economy, fisheries management continues to use a combination of input and output controls which, in turn, create the incentives for capacity to increase (rather than decrease).

1.1 Limited entry

License limitation is not a sufficient measure to reduce capacity⁸ and requires other mechanisms to control the rate of increase in capacity that will occur in the form of:

- capital stuffing (where a vessel's horsepower, length, breadth, and tonnage can increase);
- changes in gear and fishing periods or areas; and
- adoption of new technological innovations in fishing gear.

1.2 Buyback programs

Buyback programs literally buy and remove vessels, gear and/or licenses from a fleet to decrease capacity.⁹ Although the proper design of buyback programs can improve the immediate impact of buyout programs, the programs have not generally been effective in reducing capacity (Holland et al., 1999). At best, buyback programs may reduce capacity in a fishery in the short run; however, if open access fishery incentives are not addressed, improvements in the stock(s) will attract additional capacity into the fishery.

In spite of their short term impact on capacity, buyback programs can be politically advantageous, socially helpful and, indeed, managerially expedient in fisheries where there is overcapacity and there is a desire to change to incentive aligning management.

1.3 Gear and vessel restrictions

Gear and vessel restrictions attempt to restrict capacity by controlling the use of inputs in the production of fishing effort. Minimum mesh sizes, restrictions on the number of pots or traps, limits on the length of longlines, or the banning of gear are methods that have been employed in various fisheries. Regulations restricting the physical characteristics of vessels to control capacity have also been used.

In general, fishermen circumvent the regulations by substituting other factor inputs or new types of gear for the inputs that have been restricted.¹⁰

1.4 Total allowable catch

Total allowable catch (TAC) is used to maintain or rebuild fish stocks by establishing catch quotas for domestic fisheries, to allocate a fish stock between different fishing gears or user groups, and to allocate international stocks between nations.

There is general agreement that in virtually all situations, when used in isolation, TACs are an invitation to failure because they speed the growth of fishing capacity (FAO, 1998) and create reasons for fishers to race for the fish and increase harvest capacity. Regulators typically respond with shortened fishing seasons or reduced fishing times which effectively increase the harvesting costs of landing the same amount of fish in a shorter period of time. If sufficient real time data is difficult to obtain, there may be frequent overruns of the TAC – which is contradictory to the mandate to ensure that the risk of exceeding limit reference points is very low.

TACs also can create downstream problems in the processing sector. If large landings occur during increasingly short time periods, excess fish processing capacity and potentially erratic employment problems develop in the local community.

1.5 Vessel catch limits

Individual vessel catch limits are a form of individual quota without transferability between fishermen. By restricting the amount of fish landed by a vessel, the race for fish can be slowed, but fishermen

⁸ Pragmatically, limited entry licensing is also ineffective if it is not possible to determine if the vessels actually fishing have a license (FAO, 1998). If limited entry licenses are transferable, they at least allow new entrants to participate as existing participants exit the fishery.

⁹ Many countries have experience in operating buyback programs including Japan, the United States, Canada, Norway, Australia, the European Community, and Taiwan.

¹⁰ Vessel length restrictions are typically circumvented by increasing the beam of a vessel or improving the horsepower of the vessel. Gear restrictions can be circumvented by using alternative types of gear.

may be forced to circumvent catch limits by landing fish at out of the way docks and ports. Vessel catch limits can have applications in community-based fisheries and where landing sites are restricted and transshipment does not occur.

1.6 Individual effort quotas

Individual effort quotas (IEQs) limit the fishing effort a fishing craft can apply to a fishery. Usually a restriction is placed on trawl time, time away from port, or fishing days that the vessel can employ. Where IEQs are transferable, fishermen can purchase IEQs from existing fishermen or sell to new entrants. However, as with vessel catch limits, enforcement is difficult since effort is expended away from port and restrictions can be evaded.

As with gear and vessel restrictions, capital stuffing is a common occurrence under IEQ programs.¹¹ While days fished or trawl time may remain constant, the fishing power of the vessel can be increased by substituting other factor inputs, causing the effective fishing effort of the vessel to increase. As a result, fleet capacity can increase over the long run.

2 Incentive adjusting measures

Incentive adjusting measures are long run solutions to correct overcapacity because they change the regulatory environment and create market forces that reduce capacity.¹² They are designed to eliminate overcapacity by correcting the open access market externality endemic in fisheries by establishing user rights.

The purpose of incentive adjusting measures is to transform the process of competitive hunting into one of conscientious production where profit maximization of a limited resource occurs through cost minimization. When fishery resources are no longer free to whoever harvests them first, fishers have a reason to invest in the future by conserving both the fishery resource and other resources (capital and labor) used in its harvesting. The costs associated with excess and overcapacity are borne directly by the fishers themselves (internalized), and market forces drive adjustment to remove overcapacity.¹³ In short, these systems transform the stock(s) in question into a shared asset that inspires and warrants cooperative behavior to conserve and enhance the value of the asset. Thus, sustainability and commercial concerns are aligned and even reinforce each other.

Measures in this category include:

- "group" fishing rights including community development quotas (CDQs), cooperative fishing rights, community-based management user rights,
- area or region-based Territorial Use Rights (TURFs); or
- individual fishing quotas (IFQs) and individual transferable quotas (ITQs).

If the management institution is changed to allow a fisher to internalize the social cost of exploiting the resource – by establishing cooperatives, co-management, or rights-based fisheries – the consequences of overcapacity in the form of overfished stocks of fish should be corrected. FAO, 2004b

¹¹ For example, the real result of regulating days away from port and to, theoretically, reduce capacity, may be that fishermen increase vessel horsepower to reduce the travel time spent getting to the fishing grounds - thereby effectively increasing the proportion of days spent fishing.

¹² Despite the acknowledged failure of top-down command and control management systems in many sectors of the economy, there are political and social concerns about using rights based management systems in the fisheries sector.

¹³ Property rights have been developed in most primary industries: in agriculture, farmers purchase or lease the land and have exclusive access to it; in mining, entities or individuals are provided with similarly exclusive access to certain areas for the extraction of oil or other mineral resources. In forestry, rights to harvest are generally given to a limited number of individuals who are given exclusive access to particular areas; however, as in fisheries, these rights have not always been clearly defined, and in areas where unrestricted access to forests still exists, unsustainable harvests occur, and forest resources are overexploited.

2.1 Group and area fishing rights

Community-based, co-management, and territorial use right (TURF) systems have been introduced in several countries with some success at controlling and reducing capacity. These systems represent a potential means to control capacity by causing fishers to behave as if property rights for a fishery, fishing area, or region exist. Access to, and use of, a particular fishing ground – however the areas is delimited - is restricted to the group which determines how to harvest fish from the fishery and to whom the fish in the fishery are allocated.

A key to the success of these programs has been in the ability to define the relevant "community" or "territory" (area). Under these programs, a wide range of potential decisions and outcomes exists, simply because the governing group may apply any management method for governing capacity. Even so, these systems have been effective, particularly if there is institution building capability regarding fisheries management, restricted membership; and the ability to enforce rights and rules within the area covered by the fishery or fisheries.¹⁴

2.2 Individual fishing and individual transferable quotas

Individual fishing quotas (IFQs) and individual transferable quotas (ITQs) explicitly limit the fish that a fleet can harvest from a fishery and assign tradable shares of the total catch to the participants in the fishery. These transferable harvest rights give fishers a financial incentive to reduce capital investment and labor used in harvesting the fish stock in order to increase individual profitability.

Found to have been effective at controlling capacity in the fisheries to which they have been applied, these measures are not believed to be practicable in all cases. A capacity cascade or displacement of capacity may occur if these measures are sequentially adopted in a series of fisheries because the overcapacity is likely to move from one fishery to the next. Nonetheless, by addressing the open access problem, these programmes have had a positive effect on reducing capacity by either lengthening the fishing season or reducing the number of vessels in the fleet.

¹⁴ For group fishing rights systems to be effective, the group must be able to exclude outsiders and to enforce their group right.