Australian Government

Structural adjustment in AUSTRALIAN FISHERIES

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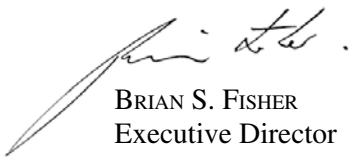
foreword

There is increasing concern worldwide about the capacity of global fishing fleets and the associated impacts of these fleets on fish stocks and, in turn, about the economic performance of the world's fisheries. Given this, there is an ongoing need for fisheries managers and policy makers to examine the nature and extent of fishing effort and the structure of fishing fleets to ensure that fisheries are capable of long term sustainable and profitable production.

Structural adjustment of fishing fleets may be required to ensure that stocks are maintained and that the benefits to the community from the exploitation of the fisheries resource are maximised. However, whether these adjustments should be allowed to occur autonomously, as operators respond to changing conditions, or induced through policy intervention, is often debated.

This report presents some general principles about the nature and cause of, and potential solutions to, capacity problems in fisheries. From a series of case studies, some general principles are distilled on the role of government in obtaining actual long term solutions to capacity problems in Australian fisheries.



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summary

The overcapitalisation of global fishing fleets and the associated impacts on fish stocks and the economic performance of fisheries are of great concern worldwide. Given this, fisheries managers and policy makers need to examine the nature and extent of fishing effort and the structure of fishing fleets to ensure that fisheries are capable of long term sustainable and profitable production. Both autonomous and induced structural adjustments may be required to ensure that stocks are maintained and that the benefits to the community from the exploitation of the fisheries resource are maximised.

Structural adjustment in fisheries

Governments are frequently lobbied to provide adjustment assistance for industries experiencing financial difficulties brought about by changing circumstances. Structural adjustment in response to changing circumstances is the ongoing shift in distribution of activities and resources within and between individuals and firms, in an attempt to improve efficiency, contribute to economic growth and raise living standards (Productivity Commission 1999). From a fisheries perspective, structural adjustment also implies a concentrated or focused change in management procedures to resolve the imbalance between the current level of effort and capitalisation in various fisheries and the socially optimal level.

The three most prevalent pressures for structural adjustment in the fisheries sector arise from: capacity management problems, and the associated depletion of stocks and decline in operator returns; changing market conditions; and resource reallocation. While all of these pressures should result in some form of structural adjustment, government involvement may not always be warranted.

Role of government

The role of government in the structural adjustment of an industry has been widely debated by a number of authors for a wide array of industries (Productivity Commission 1999). Issues discussed have included the role of government in the adjustment of industries in response to both market and policy based changes, how any distributional effects

should be dealt with, and the best approaches to support the adjustment process. In this report, a number of case studies are drawn on to distil several key principles for policy makers and fisheries managers on when and how structural adjustment should be carried out in the fisheries sector to ensure genuine, sustained benefits at least cost.

Governments have a specific role to play in preventing the market failures that occur with open access fisheries and lead to unsustainable harvests and the dissipation of economic returns. The primary role for government in structural adjustment is to establish a management regime that removes any incentives that lead to overcapacity, and facilitates autonomous adjustment to occur in response to changing economic and biological conditions. Overcapacity refers to the difference between what could potentially be produced by operators and the socially optimal level of production. The problem results from a market failure caused by the lack of clearly defined and enforceable access rights. In these cases, structural change, induced through management change, is required to ensure the economic and biological sustainability of the fishery.

Excess capacity and adjustment

It is important to differentiate overcapacity from the problem of excess capacity. Excess capacity relates to the situation where the level of physical capital (capacity) in a fishery is in excess of what would be required to capture a given level of stock. Excess capacity arises when the market is in disequilibrium as it moves from one long term equilibrium to the next and, provided access rights are well defined, should correct itself autonomously of any government intervention. From a pure stock conservation perspective, the existence of excess capacity does not pose any significant threat provided that the total output of the fishery is constrained to a sustainable level (for example, through an enforced total allowable catch quota). However, the existence of excess capacity results in economic returns generated by operators being lower than they would have been otherwise.

Autonomous adjustment following a management change may be relatively slow. A key factor influencing the rate of change is the alternative uses for retired capital. If there is not another fishery in which a vessel can be used it may be rational for an operator to delay exiting the fishery until the vessel is at or near the end of its economic life.

A decommissioning program can help facilitate structural change under a new management scheme. First, it will reduce the disincentive for operators to leave the industry as vessel disposal becomes less of an issue and, second, the quota trading price is likely to be lower because additional quota will come onto the market when boats are decommissioned (Pascoe et al. 2002). This should lead to quota consolidation and an associated reduction in excess capacity. However, this type of adjustment scheme is likely to be more costly than allowing the fishery to adjust autonomously. While the final level of annual economic returns should be the same as that under autonomous adjustment, the scheme will have removed capital and labor (that has a low opportunity cost) prematurely from the fishery.

Structural adjustment schemes

The argument promoted above assumes that managers can set a total allowable catch (TAC) or total allowable effort (TAE) that controls effort and catch effectively. However, if the presence of substantial excess capacity means that managers are unable to set catch or effort levels consistent with the long term efficient management of the fishery, then an adjustment scheme may be warranted. In addition, if the fishery requires urgent adjustment to avoid serious or irreversible damage, it may be desirable for government to become more actively involved in the process, to ensure that sustainability objectives are not postponed.

It is important that capacity reduction and structural adjustment schemes are not seen as measures that managers use periodically, as capital investment decisions will be distorted. The existence of vessel and licence buyback programs can create an expectation that government will cover any losses that may arise from excess investments in vessels. Expectations of future buyback schemes may also be one reason why operators hold inactive or dual permits.

While the goal of structural adjustment is to remove active effort from a fishery, this is difficult when there are idle licences and gear. There are limited benefits in retiring active effort if there remains latent effort in the fishery that can easily become active or transferred to other vessels. That is, if the removal of active effort improves the economic performance of a fishery, then it may become viable for operators who had previously dropped out of the fishery to become active again. It is

important that both active and latent effort are removed from an overcapitalised fishery.

The cost of buyback schemes can be minimised if a competitive tender system is used. A competitive tender also allows for further information to be gathered from operators such that offers can be discriminated on more than price alone. An obvious application is to discriminate between active and latent permits. For this system to work it is important that the scheme operates at arms length from the industry so that the reserve price (or other selection criteria) is not known by operators.

A potentially major problem associated with schemes designed at removing capital from a fishery relates to the subsequent uses of that capital. The 'spillover' of excess capital to other fisheries can lead to overcapitalisation or exacerbate existing overcapitalisation problems if the fishery into which the excess capital moves is not well managed. The potential for spillover effects to occur can be reduced through the introduction of effective management plans that assign access rights to operators and prevent capital from freely flowing into a fishery. In some cases the threat of the spillover of capital may lead to more rapid reform of management arrangements, such as individual access rights, being introduced in other fisheries. However, the potential for the spillover of capital may be a significant issue for high seas fisheries where management plans that effectively constrain fishing effort are difficult to implement.

Government and industry funding of schemes

To ensure that the benefits of restructuring are not dissipated over time, any government financial assistance for the removal of capacity should depend on the implementation of new management arrangements that effectively constrain effort and catches and encourage autonomous adjustment. Unless there is an effective fisheries management system in place that addresses overcapacity, subsidies designed to reduce fishing effort, such as decommissioning schemes, will not have any long term impact on fisheries profitability (or sustainability), as they do not change the underlying incentives that created the capacity problem.

The major beneficiaries of a reduction in overcapacity will be the operators that remain in the fishery. As a result, it is possible to design adjustment schemes that are partially funded by industry. Where the reduction in fishing effort is sought for environmental reasons by government

on behalf of society, there may be a role for government expenditure to bring about the desired change. The Australian Government's policy is that fisheries management regimes are designed to facilitate market based autonomous adjustment to changes in fisheries management arrangements. However, where marine protected areas or zones create requirements for fishing effort reduction that are additional to those required to meet fishery management objectives, Australian Government funded adjustment assistance may be considered (Department of Environment and Heritage 2004).

Generally, government should play a very limited role in adjusting fisheries on the basis of market based pressures such as unfavorable price (output and input), exchange rate or interest rate movements. The fisheries sector, like all industries, is exposed to a number of pressures that should lead to autonomous restructuring. The structural adjustment of a fishery facing market pressures, in most cases, should be autonomous and require no government intervention. Operators within a fishery should be exposed to the risks of the market, and adjust accordingly when conditions change. By assisting an industry when economic circumstances are unfavorable, an expectation is created that government will intervene in the future. This will tend to lower the perceived risks of investing in fishing capital and contribute to the buildup of excess capacity.

introduction

There is increasing concern worldwide about the excess capacity or overcapitalisation of global fishing fleets and the associated impacts on fish stocks and the economic performance of fisheries. Given this, there is an ongoing need for fisheries managers and policy makers to examine the nature and extent of fishing effort and the structure of fishing fleets to ensure that fisheries are capable of long term sustainable production. Both autonomous and induced structural adjustments may be required to ensure that stocks are maintained and that the benefits to the community from the exploitation of the fisheries resource are maximised.

The role of government in the structural adjustment of an industry has been widely debated. For example, issues such as the role of government in the adjustment of industries in response to both market and policy based changes, how any distributional effects should be dealt with, and the best approaches to support the adjustment process, have been discussed by a number of authors with varying views.

The structure of fisheries in Australia is constantly changing as operators respond to changing economic conditions (such as price fluctuations), environmental conditions (such as stock numbers), and the institutional environment (such as management arrangements) in order to maximise wealth. Changes to these underlying conditions provide an incentive for fishers to rearrange the way in which they operate within a fishery. To some extent, structural adjustment occurs autonomously of any intervention, driven by the profit motives of operators alone. However, the management arrangements of a fishery produce a number of incentives and constraints that shape the structure of a fishery. These may require adjustment over time to induce change that ensures the sustainability and economic viability of a fishery.

From a public policy perspective it is important for government to seek to answer five fundamental questions before committing to a program to induce structural adjustment in a fishery:

- Is there a structural problem in the fishery (excess capacity or overcapacity)?
- What caused the structural problem to arise?
- Will structural change occur autonomously or is some form of intervention required?
- What is the most appropriate and cost effective form of intervention?
- How active a role should the government take in the adjustment process?

The concept of structural adjustment and capacity management in the fisheries sector is introduced in chapter 2 of this report. The key pressures for structural adjustment in the fisheries sector are then discussed in chapter 3 and the appropriate role of government in response to these pressures outlined. Advantages and disadvantages of various methods of adjustment that can be utilised by fisheries mangers and policy makers are examined in chapter 6. A series of case studies is then provided as a way of examining the success, or otherwise, of previous policy induced changes. From the case studies, some general principles can be distilled about the role of government in the structural adjustment of Australian fisheries.

the need for adjustment

Structural adjustment is a term that in recent years has been used in association with compensation packages and other measures used to deal with equity issues arising from management and other resource allocation decisions. While many structural adjustment packages may contain some elements that attempt to facilitate a change through payments to stakeholders, structural adjustment or change, of itself, is concerned with the ongoing shift in the distribution of activities and resources within and between individuals and firms, in an attempt to improve efficiency, contribute to economic growth, and raise living standards (Productivity Commission 1999).

Efficiency is a multidimensional concept that can be separated into three key elements. First, technical efficiency requires producers to obtain the maximum output from a given set of productive resources (Productivity Commission 1999). An increase in technical efficiency would involve operators using existing technology better to increases output, without investing in larger engines and bigger nets, to increase catch per unit of effort expended.

Second, allocative efficiency defines a situation in which producers have the maximum incentive to reallocate resources from activities of low net value to activities of high net value (Productivity Commission 1999). Increases in allocative efficiency can occur at both the fishery and vessel levels. At the fishery level, resources may be reallocated between fisheries and licences, quota or gear units can move from less efficient to more efficient operators. At the vessel level, allocative efficiency may involve operators changing input combinations to increase catch per unit effort or reallocating resources between target species.

Effort creep is the term applied to the continual increase in catching power that occurs in fisheries as a result of technical innovation or the uptake of unregulated fishing inputs (allocative efficiency) and improvements in technical efficiency.

Finally, dynamic efficiency requires producers to respond speedily and flexibly to changing conditions. That is, structural change should be an ongoing process, with autonomous changes occurring frequently as economic agents attempt to maximise wealth given the institutional and environmental constraints of the time and the prevailing market conditions.

Governments are frequently lobbied to provide adjustment assistance for industries experiencing financial difficulties brought about by changing circumstances. To date, the primary

impetus for adjustment programs in Australian fisheries has been stock depletion and the associated decline in operator returns. Although not all fisheries that have undergone adjustment involved stocks that were in trouble, stock depletion has often provided the motivation for adjustment programs, such as in the southern shark fishery, southern rock lobster, southern bluefin tuna and some south east trawl species (Metzner and Rawlinson 1998).

Market factors, such as fluctuations in input and output prices, exchange rates and interest rates, can also result in pressure for adjustment. Despite limited entry in the majority of Australian fisheries, many are characterised by poor financial conditions and operating inefficiencies.

The third category of events that provide an impetus for adjustment is the reallocation of resources between sectors. Such allocations may occur within a sector among the commercial fishing gear groups; between the commercial and recreation sectors; or between consumptive users and conservation. These allocation issues have provided the motivation for adjustment programs in the past, and will continue to do so in the future as societal preferences change.

An important consideration is the role of government in responding to market based pressures, as opposed to policy induced pressures or changes to access rights. In general, fisheries operators seek a structural adjustment package when the conditions in the fishery leave operators experiencing financial hardship. However, the source of this hardship is fundamental to determining whether government intervention to induce structural adjustment is warranted, and if so, what role government should play.

The three key pressures that affect operators are discussed below. Some general principles for government involvement are discussed in reference to each pressure.

Capacity management

Excess fishing capacity is affecting the sustainability of many fisheries, undermining many of the conservation and management efforts undertaken and leading to significant economic waste (Greboval and Munro 1999).

Overcapacity in world fishing fleets is a significant contributor to the overexploitation of world fishery resources and imposes heavy economic losses on society (FAO 1997). Suboptimal management arrangements may result in capacity problems in a fishery, placing pressure on the fishery resource. Changes will need to be made to the management of the fishery (the rules of access to the fishery) if the existing arrangements are providing the incentives for both the accumulation of excess capacity and overcapacity in the fishery.

The fisheries sector exhibits a number of characteristics that separate it from most other industries. First, in the economics of the fishery, it is important to think in terms of the stock of two forms of capital — the 'natural' capital (fish stocks) and the physical capital in the form of the fleet. Of fundamental importance is that these two forms of capital interact with one another (Greboval and Munro 1999).

The second characteristic is concerned with the specification of access rights to the fisheries resource, and the associated market failures that arise from the nature of these rights. As outlined in Commonwealth of Australia (1989), governments have a specific role to play in preventing the market failures that occur with open access fisheries and lead to unsustainable harvests and the dissipation of economic returns. In Commonwealth fisheries the government holds title to the resource, on behalf of the Australian community as a whole, and therefore the government has primary responsibility for ensuring that the net value of the resource to the Australian community as a whole is maximised (Gooday and Galeano 2003).

The term 'resource rent' is used to describe the part of the return from the use of a natural resource that is caused by the scarcity of that resource. Rent to a resource is the return to ownership of the resource, net of all production costs other than the cost of acquiring the use of the resource itself.

Where there is free access to a fishery, fishing effort will expand (through the entry of new operators and the expansion of existing operations) until the point where there are no excess profits to be captured (that is, resource rents are completely dissipated). The problem results from poorly defined property rights over the fishery resource. In an open access fishery, individual fishers are unable to:

- exclude others from using the resource
- extract exclusive income from the resource and
- transfer or exchange the right to exploit the resource.

The lack of exclusivity over fishing rights results in a 'race to fish', with each fisher trying to get to the fish first in order to maximise their share of the total harvest. Unrestrained competition and a lack of any incentive to conserve the stock results in rent dissipation, in some cases stock depletion, excess capitalisation and the inefficient allocation of society's resources (see, for example, Gordon 1954; Scott 1955; Clark 1976). It follows that there is a potential net payoff involved with the movement from an open access fishery to one where the incentives to 'race to fish' are reduced.

Excess capacity and overcapacity

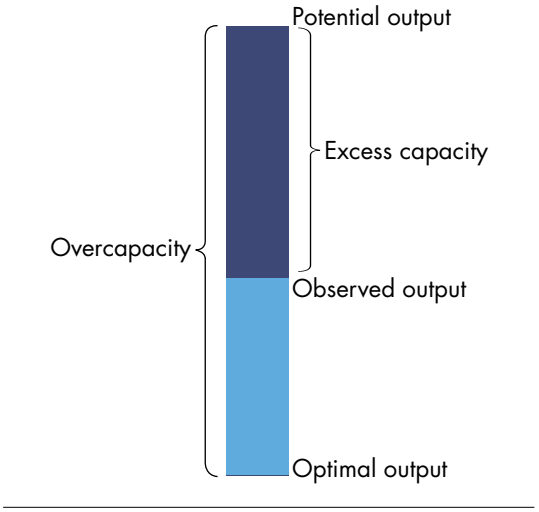
The OECD Fisheries Committee defines excess harvesting capacity as the 'harvesting capacity in excess of the minimum amount required to harvest the desired quantity of fish at least cost' (OECD 1996). This results in economic waste from society's point of view; however, from the viewpoint of operators, the investment in excess capacity is entirely rational. In contrast to other industries, overcapitalisation is not a short run phenomenon, given the open access nature of many fisheries, and can be expected to be of indefinite duration.

The terms excess capacity, overcapacity and overcapitalisation have been used as synonyms in the past. The Food and Agriculture Organisation (FAO) and the US National Marine Fisheries Service have agreed on two concepts of capacity in fisheries, which are illustrated in figure A. One concept is excess capacity, which is defined as 'the difference between the maximum potential output — given technology, current resource conditions and full and

efficient utilisation of capital stock, other fixed and variable factors — and the observed output' (Pascoe et al. 2003).

The other concept, and the one that appears to be of greatest concern to resource managers, is overcapacity. Following Pascoe et al. (2003), overcapacity can be defined as the difference between the maximum potential output that could be produced (given technology, current resource conditions, and full and efficient use of capital stock and other fixed and variable inputs) and a desired optimum level of output (given current technology and resource conditions). If the problem of overcapacity is not addressed, in the long run it will lead to a running down of fish stocks and the dissipation of economic returns.

A Excess and overcapacity



The distinction between the two concepts is quite important for fishery managers concerned about reducing capacity in fisheries. Excess capacity is a problem that can possibly self correct. That is, excess capacity may occur when shifts in supply and demand cause disequilibrium in the market (Pascoe et al. 2003). In these situations, firms can autonomously adjust their capital and variable inputs to either increase or decrease production. In contrast, overcapacity usually occurs because the market fails to efficiently allocate inputs and outputs. Firms cannot prevent other individuals from harvesting the resource, and there are no incentives to conserve inputs or outputs. An overcapacity problem will persist until effective fisheries management arrangements are implemented or the fishery collapses.

From a pure stock conservation perspective, the existence of excess capacity does not pose any significant threat provided that the total output of the fishery is constrained to a sustainable level (for example, through an enforced total allowable catch quota). However, the existence of excess capacity creates an economic problem in that economic returns generated by operators are lower than they would be otherwise. At the aggregate fishery level, the existence of excess capacity indicates a waste of resources, as, by definition, the same catch could have been taken by fewer vessels, using less inputs (in aggregate).

The existence of capacity management problems will not only lead to the dissipation of resource rents, but this in turn will cause the industry to be vulnerable to adverse resource and economic shocks. Hence, it can be anticipated that fisheries with excess capacity will request government assistance from time to time to relieve economic stress (Greboval and Munro 1999). Poor financial conditions will also provide incentives for operators to pressure managers to set liberal controls in the hope of alleviating short term financial pressures. This will exacerbate the problem.

A change to the management regime that governs a fishery modifies the economic incentives to invest and operate in the fishery. Therefore, changes may leave some operators who have already made substantial investments worse off, and with substantial nonmalleable capital. In these cases there may be a case for structural adjustment assistance on equity grounds. The concepts of 'malleable' and 'nonmalleable' vessel capital have now been adopted by the FAO (Greboval and Munroe 1999). Malleability refers to the ease with which vessels can be removed from a fishery. Perfectly malleable capital is capital that can be disposed of without fear of capital loss. On the other hand, perfectly nonmalleable capital is capital that cannot be sold once it is acquired. Most fishing capital can be considered largely nonmalleable because it has limited uses once removed from a fishery.

The major beneficiaries of a reduction in capacity will be the operators that remain in the fishery. As a result, it is possible to design adjustment schemes that are all or partially funded by industry. In order to ensure that the benefits of restructuring are not dissipated over time, any government financial assistance in the removal of overcapacity should be dependent on the implementation of new management arrangements that effectively constrain effort and catches and encourage autonomous adjustment.

Market pressures

All industries are exposed to pressures in the form of market fluctuations. These include changes to output prices, input prices, exchange rates and interest rates. An unfavorable change in one or more of these variables can quickly turn a profitable fishery into one struggling to remain viable, and requiring some form of structural adjustment. The structural adjustment of a fishery facing economic pressures, in most cases, should be autonomous and require no government intervention. Operators within a fishery should be exposed to the risks of the market, and adjust accordingly when conditions change. That is, the industry needs to display dynamic efficiency and respond to long term changes and be resilient to any short term fluctuations. In a fisheries context, this form of structural adjustment is in response to excess capacity, and should not be confused with the problems associated with overcapacity.

In general the government should play a very limited role in adjusting fisheries in response to market pressures. If adjustment schemes are seen as measures that managers and policy makers will use periodically, then capital investment decisions will be distorted. By assisting an industry when economic circumstances are unfavorable, an expectation is created that government will intervene in the future. Therefore, operators may overcapitalise during favorable economic conditions, for example when the Australian dollar is relatively low, and expect assistance when the exchange rate rises. That is, the expectation of adjustment assistance is likely to lower the perceived risks associated with investing in fishing capital, and can create an expectation that government will cover any losses that may arise from excess investments in vessels.

Resource use conflicts

Increasingly, there is pressure on governments to reduce the amount of effort in a fishery for conservation reasons that are largely independent of commercial fishing activities. This

may involve area closures through changes in zoning, vessel buybacks, or changes to quota allocations. There are many examples in Australia, including the east coast trawl fishery in Queensland, which is still undergoing structural change associated with the rezoning of the Great Barrier Reef Marine Park.

Where the reduction in fishing effort is sought for environmental reasons by government on the behalf of society, there may be a role for government expenditure to bring about the desired change. The Australian Government's policy is that fisheries management regimes are designed to facilitate market based autonomous adjustment to changes in fisheries management arrangements. Where fishing effort has been or should be removed from a fishery through normal management action to meet fisheries objectives, government funded adjustment assistance is not preferred, and has only been used to facilitate the introduction of new fisheries management arrangements (Department of Environment and Heritage 2004). However, where marine protected areas or zones create additional requirements for fishing effort reduction beyond that required to meet fisheries management objectives, Australian government funded adjustment assistance may be considered to support the additional adjustment to fishing effort (Department of Environment and Heritage 2004).

Reseach by Kompas and Grafton (2004) suggests that establishing appropriate marine reserves can lead to an improvement in economic returns to operators. This implies that cost sharing arangments may be appropriate in some circumstances, even when effort is reduced primarily for conservation reasons.

capacity adjustment mechanisms

The literature reveals three major methods for adjusting capacity in a fishery — output controls, input controls, and buyout and decommissioning schemes. Output and input controls are fisheries management regimes designed to manage overcapacity, while decommissioning schemes can be used to augment fisheries management regimes.

Output controls

Output controls attempt to limit the quantity of fish that is extracted from a fishery. Often output controls are defined as individual transferable quotas that limit the amount that an individual fisher may land and allow for trade between operators. Output controls are not capacity management measures as such. They affect the level of output, and this directly influences the level of capacity utilisation in the fleet rather than capacity itself (Pascoe et al. 2002). One of the indirect advantages of individual transferable quotas is that they also create incentives for autonomous fleet rationalisation and capacity reduction. That is, they address the market failure resulting in overcapacity and the excess capacity problems simultaneously, provided the total allowable catch is set appropriately.

Aggregate or competitive quotas

A basic form of output control is the aggregate total allowable catch (TAC). With aggregate quotas, the total quantity of fish that can be landed over the year (or season) is limited. While limiting the total catch from the fishery (thereby possibly achieving some biological conservation objectives), the fishing activity is still competitive, because under free and open access, fishers have the incentive to harvest as much as they can as quickly as possible before the TAC is reached and the fishery is closed. Incentives are created to race for the fish — it can be expected that larger and more powerful vessels will be employed.

TACs control output directly, but do not control capacity. Although biological objectives may be achieved, the incentives to increase input use in the race to fish result in high levels of excess capacity and low levels of capacity utilisation (Pascoe et al. 2002). If the fishery is managed under limited access arrangements, then the pool of operators is defined, but the incentives are the same as for an open access fishery. Greboval and Munro (1999, p. 21) concludes that '… as far as capacity control is concerned, the TACs only policy is an unmitigated disaster.'

Individual transferable quotas

Individual transferable quotas (ITQs) have been widely advocated and are increasingly used to manage wild fisheries (Pascoe et al. 2002). In principle, ITQs have the potential to overcome the incentive problems of excessive investment and excessive effort that lead to dissipation of potential resource rent common under alternative management regimes. By providing each quota holder with effective ownership of a known portion of total catch, ITQs can eliminate competitive fishing. Consequently, profit maximising behavior by individual fishers results in maximum net returns to the fishery as a whole, provided that the TAC is set appropriately.

ITQs are traded between fishers so that each fisher can adjust their quota holdings to best suit their fishing operation. Transferable quotas will develop a value in their own right depending on the amount of profit that can be generated from the fishing activity. Thus, it can be expected that quota will be transferred from relatively inefficient to efficient operators. This form of structural adjustment is in response to excess capacity, and should not be confused with the problems associated with overcapacity.

ITQs work best in high value, single species fisheries with stable abundance. The efficiency of ITQ management can be enhanced with good information about fish stocks, fishing costs, revenues and production relationships, and landings and discarding levels (Pascoe et al. 2002). In practice, few fisheries display all of these characteristics and ITQs have some limitations. In particular, highgrading in single species fisheries or discarding species for which the quota is filled in multispecies fisheries may be problems when ITQs are most easily enforced as landing quotas.

Input controls

Input controls generally aim to limit or reduce the level of harvesting capacity by limiting or reducing the level of inputs employed in the fishery.

While input controls can have a direct impact on the level of use of those inputs that are regulated, assessing the effectiveness of input controls in many fisheries is less straightforward. The relationship between effort and output is complex, and varies with increases in fishing power and technical efficiency that result from technical change. This means that the fishery manager has to continually reduce input levels in order to maintain target levels of output. A common feature of input controls is the tendency for fishers to substitute unrestricted inputs for restricted inputs.

Mandatory gear reduction programs in Australia have been used in a number of fisheries as a way of reducing fishing effort. Examples include changes to the number of lobster pots (Victorian rock lobster fishery, 1982; South Australian rock lobster fishery, 1984), or allowable net length (Northern Territory barramundi fishery and southern shark fishery). While mandatory reductions may result in all operators facing the same relative cutbacks, it can result in large inefficiencies. Without trading mechanisms in place to allow effort units to move to more technically efficient operators, the economic performance of the fishery will decline.

Establishing individually transferable effort quotas (ITEQs) would require a homogeneous effort unit to be derived within the fishery that could be capped and traded. The total capacity of the fleet would then be controlled through limiting the total number of units available in the fishery to a level that was expected to equate to the target level of output (Pascoe et al. 2002). Rationalisation of effort units through transfers would result in a reduction in excess capacity, as operators who sold their quota would leave the fishery.

Changing the management regime to an ITEQ system would also result in similar outcomes to those experienced under an ITQ system, as effort quota would readjust until vessels were fishing at their optimum capacity. However, in order to balance the fleet capacity with the resource, the total allowable effort (TAE) would need to be constantly adjusted in order to account for technical change. There would be a strong incentive for operators to adopt new technologies and substitute uncontrolled inputs for the controlled inputs, resulting in effort creep. The result would be increasing levels of effective effort, which would need to be accounted for when setting the TAE. The northern prawn case study provides a good example of the short lived nature of structural adjustment programs in input controlled fisheries (see chapter 4). In contrast, in a fishery controlled using ITQs and an appropriate TAC, effort creep is realised as a productivity gain, with no associated impact on stocks.

The benefits derived from applying input based structural adjustment programs aimed at reducing capacity in a fishery are typically short lived in nature, as the remaining participants still have an incentive to increase their effort. Despite this, the use of limited entry, in conjunction with increasingly restrictive input controls, has, in several instances, delayed the buildup of overcapacity. However, as indicated in the case studies, the use of input controls alone has several limitations, and in the long run effort creep results in overcapacity. Greboval and Munro (1999) conclude that overall the evidence suggests that transferable effort quotas do little to stem effort creep or the race to fish.

Decommissioning schemes

Buyback programs can involve the removal of vessels from a fishery and/or the purchase of access licences or entitlements. The goal of a buyback scheme is to remove capacity, in the form of vessels or other gear, from the fishery for either biological or economic reasons. Buyback programs have also been implemented to reduce conflict between sectors or to reallocate resources from the commercial sector to the recreational sector (Metzner and Rawlinson 1998). While licence retirement may remove physical capital from a fishery, human capital such as the skills and knowledge of the crew may remain in the fishery.

Metzner and Rawlinson (1998) specify three mechanisms for buyback programs:

- fixed or calculated values for entitlements or gear
- negotiated amounts for licences or gear
- sealed bids or competitive tender.

First price, sealed bid auctions require bidders to submit single confidential bids to the seller. The bidder with the highest bid wins and pays that bid. Vickrey auctions have a second price, sealed bid format. The bidder making the highest bid wins and pays the next

highest bid. In the case of buyback programs, operators submit bids to the scheme and the lowest bid wins and are paid that bid. Additional information may be required to help discriminate between the bids and achieve the greatest impact for least cost.

Coupled with this, there are three ways of addressing the issue of effort displacement:

- mandatory gear or vessel scrapping requirements
- regulatory restrictions on subsequent use of vessels and entitlements
- no restrictions on subsequent activities in other fisheries.

Buyback programs may be voluntary, mandatory or a combination of the two. These schemes have often been successful in attaining the mandated objective in terms of gear removal, but the rate of removal has depended on whether the buyback is voluntary or mandatory and whether the buyback period is specified. It is difficult to assess the success of these programs in terms of the effective effort removed, increases in economic efficiency, the effect on the stock condition, and the long term impacts and durability of the programs (Metzner and Rawlinson 1998). Fox et al. (2004) have undertaken some analysis of the success of the adjustment process in the south east trawl fishery, which is discussed in the case study.

Under a decommissioning scheme that uses a tendering process, the fisher willing to leave the fishery at the lowest payment per unit is likely to be the least profitable. Fishers that are highly profitable will be expected to require higher payments to leave the fishery than less profitable fishers. Assuming that the least technically efficient vessels are also the least profitable, then these vessels are likely to leave the fishery first. As a result the reduction in effective capacity (actual catching power) will not be as great as the reduction in nominal capacity (boats or gear units).

Experience in other countries suggests that both the design of the buyback scheme and the nature and extent of management measures in place in a fishery are crucial in determining whether a decommissioning scheme will achieve the objective of not only reducing nominal fishing capacity, but also reducing real capacity. Table 1 summarises the impact that capacity reduction schemes can have under different management regimes. The table is divided into two categories in which operators either have individual rights, such as individual catch or effort quotas, or operators compete under a global management regime, such as a competitive total allowable catch or limited season length. 'Global management' involves restrictions on either inputs or catch for the fishery as a whole, rather than assigning property rights to individual operators.

If output controls are in place in a fishery then a decommissioning scheme should improve the economic returns of remaining fishers, in both the short and long term provided that an appropriate TAC is set. However, if management is dependent on effort controls it is likely that over time effort creep will widen the gap between nominal and real effort, thus undoing any short term effects of a buyback scheme. If a global rights regime is in place there is very little scope for a decommissioning scheme to be successful in the long term.

1 Impact of decommissioning schemes under different management regimes

Individual rights		Global management	
Output controls	**Input controls**	**Output controls**	**Input controls**
No effect on stock **a** Improved returns to operators (long and short term)	Effort reduced in short term, some stock recovery and improved returns Effort creep in long term and dissipation of economic returns	No effect on stock Some short term increase in returns Economic returns dissipated in long term (race to fish incentives still exist)	Effort reduced in short term, some stock recovery and improved returns Effort creep in long term and dissipation of economic returns

a If there is no excess capacity in the fishery, then initially the TAC may become nonbinding, resulting in some increase in stocks.

It will often be beneficial to address excess capacity prior to or in conjunction with the implementation of a new management regime. For example, the implementation of an ITQ management regime is likely to result in excess capacity removed from a fishery through quota consolidation. However, this may be a slow process, as many of the vessels in a fishery may have very limited uses outside the fishery and as a result have a low market value. In such a circumstance, it may be rational for an operator to delay leaving the fishery until the vessel is at or near the end of its economic life.

A decommissioning program can help facilitate structural change under a new management scheme. First, it will reduce the disincentive for operators to leave the industry as vessel disposal becomes less of an issue and, second, the quota trading price is likely to be lower, as it will not need to include a capital element to compensate operators who leave the fishery for their lost capital investment (Pascoe et al. 2002). This should lead to quota consolidation and an associated reduction in excess capacity. However, this type of adjustment scheme is likely to be more costly than allowing the fishery to adjust autonomously. While the final level of annual economic returns should be the same as that under autonomous adjustment, the scheme will have removed capital and labor (that has a low opportunity cost) prematurely from the fishery.

The argument promoted above assumes that managers can set TACs or TAEs that control catches and effort at effective levels. However, if the presence of substantial overcapacity means that managers are unable to set catch or effort levels consistent with the long term efficient management of the fishery, then an adjustment scheme may be warranted.

The management regime in place following restructure of a fishery will determine the effectiveness of structural adjustment programs and the longevity of any benefits arising from the change. Arnason (1998) notes that unless there is an effective fisheries management system in place, subsidies designed to reduce fishing effort will not have any long term impact on fisheries profitability (or sustainability), as the excess capacity reduction scheme will not change the underlying incentives that created the capacity problem. In addition, Munro (1998) argues that if buyback schemes are seen as measures that managers

will use periodically, then capital investment decisions will be distorted. The existence of vessel and licence buyback programs can create an expectation that government will cover any losses that may arise from excess investments in vessels. According to Munro and Sumaila (2001) there is evidence that capacity does seep back into fisheries after a buyback or decommissioning scheme. If the need for future decommissioning schemes is anticipated by operators, the trickle of capacity back into the fishery can be expected to increase dramatically (Munro and Sumaila 2001). Expectations of future buyback schemes may also be one reason why operators hold inactive or dual permits.

Active and latent effort

The removal of latent effort, as well as active effort, is also important to ensure successful structural adjustment. Latent effort refers to vessels that are licensed to operate in a fishery, but are not currently active. Gear units or output quota that are not currently being utilised can also be considered as latent effort. It has been claimed that a number of adjustment schemes have done little more than purchase inactive capacity out of the fisheries, with no subsequent improvements to stocks or the economic performance of the fisheries (Meany 1993).

While the goal of structural adjustment is to remove active effort from a fishery, this is difficult when there are idle licences and gear. There are limited benefits in retiring active effort if there remains latent effort in the fishery that can easily become active or transferred to other vessels. That is, if the removal of active effort improves the economic performance of a fishery, then it may become viable for those operators who had previously dropped out of the fishery to become active again.

Latent effort can exist for a number of reasons, most of which relate to the expectation that at a future date these permits or quota are going to be worth more. Operators may develop expectations that their current latent effort will appreciate in value as either active effort if net returns improve, or as an asset that can either be sold to other operators or to a buyback program.

Latent effort can result in effort 'explosions' if new fishing grounds are discovered or prices change. Regardless of the management arrangements in place, latent effort may have an impact on the effectiveness of structural adjustment schemes. Even in a fishery managed using ITQs, such as the south east trawl fishery, latent effort in the form of TACs that are not binding act as an impediment to further autonomous adjustment to remove excess capacity. The removal of latent effort through the reduction in the TAC levels could be expected to lead to an increase in quota consolidation, and a further reduction in latent physical capital (vessels) over time.

A potentially major problem associated with subsidies designed to remove capital from a fishery is associated with subsequent uses of that capital. There are a number of possible options for the use of excess capital. Where the vessels concerned have distant water capabilities they could be redirected to high seas fisheries or to the exclusive economic zones (EEZs) of other coastal states. Where the vessels do not have distant water capabilities they may be redirected to more lightly regulated fisheries within the home country's EEZ or sold to fishers operating in other fisheries. Where these alternatives are not viable, vessels may

be scrapped or used in other industries (Gooday 2002). The 'spillover' of excess capital to other fisheries can lead to overcapitalisation or exacerbate existing overcapitalisation problems if the fishery into which the excess capital moves is not well managed.

The potential for spillover effects to occur can be reduced through the introduction of effective management plans that assign individual access rights to operators and prevent excess capital from freely flowing into a fishery. In some cases the threat of the spillover of capital may lead to more rapid reform of management arrangements being introduced in a fishery, such as individual access rights. However, the potential for the spillover of capital may be a significant issue for high seas fisheries where management plans that effectively constrain fishing effort are difficult to implement.

In conclusion, structural adjustment through buyback programs may be effective at reducing the level of excess capacity in a fishery but not overcapacity. This is because the overcapacity problem arises from an underlying market failure caused by the management arrangements that buybacks do not address. Given that excess capacity will adjust autonomously if access rights are well defined, allocating government revenue to buyback schemes to reduce excess capacity in a fishery should be avoided. Reducing excess capacity in conjunction with a management change that addresses overcapacity may result in some benefits. Therefore, buyback programs, which have a dubious record under strict limited entry schemes, may be a useful ancillary instrument when introducing a new management regime that effectively controls effort and catch.

case studies

Management authorities in several countries have implemented structural adjustment programs with varied success. The general goals of most programs are similar, while the specific stated objectives may vary. Most programs attempt to increase the profitability and sustainability of fisheries and simultaneously provide funds for 'social adjustment' to the biological or political event that reduced the available catch. Conservation objectives increasingly also drive adjustment programs (Holland et al. 1999).

Despite similar motivations and goals the actual implementation of adjustment schemes may vary in many aspects. In the following sections, four case studies of adjustment schemes implemented in both Commonwealth and state managed fisheries are analysed. Combinations of the three main forms of adjustment have been used in these case studies — namely, input controls, output controls and buyback schemes.

The Australian Government manages the northern prawn fishery, south east trawl fishery and southern bluefin tuna fishery. These fisheries have been analysed to highlight the differences between adjustment schemes that have been undertaken in input and output controlled fisheries.

The east coast trawl fishery, managed by the Queensland Government, has been included in the analysis to illustrate a more recent scheme, in which many of the problems of the earlier buybacks have been addressed to some extent. The fishery also has some interesting implications for funding, given the goals of the scheme.

The specific details of each case study, including the stated objective, initiating body, changes to management arrangements, source of funding, and the success of the program in reducing capacity in the fisheries are examined. These specifics also provide a general overview of the success of vessel decommissioning and licence retirement in reducing the capacity of a fishery.

Northern prawn fishery

The fishery

The northern prawn fishery is located off Australia's north coast and covers an area of approximately 800 000 square kilometres. It extends from the low water mark to the outer edge of the Australian Fishing Zone (AFZ) and is bordered by Cape York in Queensland and Cape Londonderry in Western Australia. Although it is one of the largest fisheries in

Australia, only 27 per cent of the fishery is subject to fishing. This is because of the large area closure enforced in the fishery, and the inshore nature of prawn fishing (AFMA 2001b).

The fishery targets nine commercial species of prawns, with squid also taken as an opportunistic target species along with scallops and bugs (Brown et al. 2002). Fishing in the northern prawn fishery is divided into two main seasons: a daytime fishery targeting schooling banana prawns, and a night-time fishery targeting tiger prawns. The fleet starts fishing for banana prawns at the beginning of the fishing season on 1 April. However, the banana prawn fishery presently lasts only about three to four weeks. As the banana prawn catch rates decline, the fleet progressively changes to tiger prawn fishing. This lasts until November and includes a midseason closure from mid-May until August (Brown et al. 2002).

The gross value of production (GVP) in the northern prawn fishery is the highest of any of the Commonwealth fisheries. In 2002-03, despite significant falls in GVP in both 2001-02 and 2002-03, the northern prawn fishery accounted for around 20 per cent of the total value of production from Commonwealth fisheries. Catches in the fishery are very seasonal. In 2002-03 the real GVP was around $82.5 million, compared with a high of around $175 million in 2000-01. Over the past decade, catches of banana prawns ranged from 2222 tonnes in 1999-2000 to 6286 tonnes in 2000-01.

Real net returns to the northern prawn fishery for the period 1990-91 to 2001-02 averaged around $30 million a year. In 2000-01 and 2001-02 real net returns were estimated at $61.4 million and $33 million respectively. The estimate for 2000-01 coincides with record harvests of banana prawns in that year as well as high prices (Galeano et al. 2003).

Any measure of the net return to the fishery needs to be considered in the context of market conditions and the condition of the fishery. Of particular importance are the condition of the fish stock, capital capacity, prices of the fishery's products and inputs, and the management structure of the fishery.

Management arrangements

The process of fleet restructuring and capacity reduction in the fishery has been continuous. A series of industry funded buybacks (with limited government assistance) reduced the fleet from a maximum of 302 boats in the early 1980s to a maximum of 137 in 1995. This is believed to be the most significant restructuring of a viable fishery achieved anywhere in the world. Boat numbers were 118 in 2002-03 (Galeano et al. 2003) and declined further in 2003-04.

The fishery has historically been managed through the use of input controls, which placed limits on the type and amount of prawn fishing conducted by individual vessels. Input controls include gear (net) restrictions, annual closures and limited entry.

In January 1977 the Australian Fisheries Council implemented an interim three year management plan for the fishery. The plan included a moratorium on the entry of new operators into the fishery, and the formation of the Gulf of Carpentaria Prawn Advisory

Committee, later the Northern Prawn Management Advisory Committee (NORPAC), to allow for more direct consultation with industry.

However, the success of the moratorium was limited, as the number of fishing licences granted at the commencement of the plan in 1977 was 292, up from 145 in 1976. A second three year management plan was implemented in January 1980, which again limited entry under revised criteria. However, the replacement of old with new vessels reduced the effectiveness of the plan (Senate Rural and Regional Affairs and Transport Legislation Committee 2000).

In 1984, NORPAC and the Northern Fisheries Committee were amalgamated to form NORMAC, responsible to the Australian Fisheries Service for the management of the northern prawn fishery. In an attempt to limit the increase in fishing effort, which had been occurring simply by the substitution of new trawlers for old, NORMAC introduced a new management plan creating class A and B units (Pownall 1994). Under the new management plan, a vessel required one class A unit for each cubic metre of hull volume and each kilowatt of engine power. Class B units were introduced to regulate the number of vessels licensed to operate in the fishery. In total, 133 269 class A and 302 class B units were issued by NORMAC in 1984 (AFMA 1999).

The buyback scheme

Despite the introduction of class A and B units, data compiled by CSIRO in 1986 showed a serious decline in brown tiger prawn stocks in the western Gulf of Carpentaria. At a series of meetings in Darwin in late 1986, CSIRO proposed an immediate 25 per cent reduction in fishing effort to protect prespawning tiger prawns (Pownall 1994). The objective of the scheme was to increase the sustainable yield in the fishery rather than to maximise net returns generated by operators (Pascoe 1988).

To address this issue, NORMAC introduced a buyback of class A units with an agreed target reduction to 70 000 by the start of the 1990 season. Any shortfall would be met by a compulsory acquisition at the start of the 1990 season. However, this compulsory acquisition was opposed by the industry, and later disallowed by the Senate. The voluntary buyback continued to operate, but without a specific target (Taylor and Die 1999).

Initially, only class A units were purchased by the scheme, while class B units were forfeited once the operator had less than 100 class A units. In 1997 provisions were made in the voluntary adjustment scheme to purchase class B units as well. A second aim of the policy was to reduce the number of class B units to around 160. The scheme, however, did not buy the vessel from operators, so redundant vessels could transfer to new fisheries rather than being scrapped (AFMA 1999).

Given the unspecified outcome of the voluntary buyback, NORMAC introduced other strategies to reduce fishing effort. A six week closure during the winter months (15 June to 1 August) was introduced to reduce capture of prespawning tiger prawns (Taylor and Die 1999). Operators were also restricted to towing twin gear (two nets) rather than the more widely used triple or quad gear. Finally, NORMAC implemented a more restrictive volun-

tary vessel replacement policy requiring the surrender of two class B units for a new vessel of any size (AFMA 1999).

However, it remained clear that the rate of reduction in effort was insufficient to sustain the profitability of the industry. In 1990 the Australian Government appointed a task force to examine ways of restructuring the fishery. After extended negotiations, a further reduction in class A units to 50 000 by the beginning of the 1993 season was agreed, to be achieved by a voluntary buyback scheme and a compulsory, across the board, proportional surrender of Class A units. The 50 000 limit was subsequently raised to 53 844 following agreement with industry that concessions be given to vessels under 375 class A units (AFMA 1999).

At the end of 1992, the target of 53 844 class A units had not been met, and on 1 April 1993 the remaining class A units were compulsorily acquired to reach the target. After the compulsory buyback, only 132 class B units remained, less than half the number available in the mid-1980s.

Class A and B units were subsequently rolled over as class A and B statutory fishing rights (SFRs) under the Northern Prawn Fisheries Management Plan of 1995. As part of the plan, the existing restrictions on the total number of class A SFRs (54 844) and class B SFRs (132) were maintained (AFMA 1999).

The 'voluntary adjustment scheme' (VAS) was a joint government–industry funded buyback scheme introduced in 1986, funded by a $3 million government grant and $5 million borrowed from the National Fisheries Adjustment Scheme.

A direct result of the scheme was that the price became the floor price for all other unit sales. This meant that all market sales were at or above the VAS price. Therefore the VAS price was constantly lagging below the market price. From the fishing operators' perspective they had, for a small outlay in levy payments, achieved a substantial increase in the value of their units (Meany 1993).

In 1987, increased levies were imposed to revitalise the buyback scheme and increased prices paid for forfeited licences. An accelerated buyback was initiated with still higher prices paid for licence units (Holland et al. 1999).

The buyback was financed by a $5 million government grant (to be used as an interest subsidy) and a commercial loan of $40.9 million, of which $20 million was drawn down. The loan was serviced by levies on the remaining operators. However, if the target of 50 000 units was not achieved by April 1993 there would be a pro rata surrender of units to achieve the target (Meany 1993). In total the cost of the buyback program was $43 million, of which $18 million came from levies and $25 million from loans to be repaid by unit holders. The Commonwealth contributed $8 million in grants (Holland et al. 1999).

The compulsory surrender was challenged in court, but was allowed to proceed providing that compensation would be paid if the court found that the fishing effort units were the property of the fishers. The government eventually won an appeal allowing uncompensated surrender (Holland et al. 1999).

Continual structural adjustment

Since the structural adjustment scheme, effort creep has continued to occur in the northern prawn fishery, as operators have had a financial incentive to harvest stocks as early as possible to maximise their share of the overall catch within the limitations of their vessel size and engine capacity (Commonwealth of Australia 2000). This has included both the adoption of new technology as well as the substitution of unregulated fishing inputs for regulated ones.

Innovations such as global positioning systems (GPS) and plotter systems have dramatically changed the way that operators fish. Other new technologies and practices adopted include more efficient vessel and gear designs (for example, bulbous bows and new otter board materials). Calculations by CSIRO based on actual catch data indicate that the introduction of GPS technology into the fishery in the late 1980s and early 1990s increased fishing power by around 12 per cent in just three years (CSIRO 2000).

The continual uptake of unregulated fishing inputs has also increased effective effort in the fishery. For example, following the compulsory surrender of more than 30 per cent of all Class A SFRs in 1993 a number of other input restrictions that were introduced as interim measures in 1987 were lifted (AFMA 2000). This included the removal of restrictions on net sizes and resulted in a significant increase in the size of nets that have been used since then. It is estimated that, on average, operators with less than 375 class A SFRs have increased their net sizes by more than 15 per cent since 1992 (AFMA 2000).

As a result of effort creep in the fishery, the input controls used to manage the fishery have been repeatedly reviewed. The management of the fishery has involved a number of input controls and season and area closures that have been introduced into the fishery over time in order to reduce effective fishing effort and address overcapitalisation of the fleet (Timcke et al. 1999).

The Northern Prawn Fishing Assessment Group (NPFAG) advised in the latter half of the 1990s that effective effort directed at tiger prawns was well above that required to take the maximum sustainable yield and should be reduced by 25–30 per cent. In 1997, NORMAC supported the idea of a change to the use of gear based units, but this was not implemented for several more years. The length of the closed seasons was also altered to reduce fishing effort in 1999 and 2000, making these the shortest fishing seasons for the fishery in twenty years. In July 2000, the change from managing fishing effort through units based on engine size and vessel hull volume to gear units based on the headrope length of fishing nets came into effect. AFMA considered that headrope length would represent a vessel's fishing power more closely than engine and vessel size, so would provide a better control of effort. The new system would not prevent effort creep in the future, but altering headrope length is expected to be a more direct and simplified method of reducing effort (Caton 2003).

The 1999 assessment of the fishery indicated that during 1999 the effective fishing effort on brown tiger prawns decreased by 40 per cent. The decreases were largely the result of the extended seasonal closure in that year. The effective catch per unit of effort for both species

of tiger prawn declined between 1998 and 1999 to well below the average for the previous seven years (Caton 2003).

Regular reviews of the effectiveness of management tools and subsequent adjustments are necessary but will not eliminate further effort creep in the fishery. This is because changes in the regulation of input controls will create incentives for operators to change their input combinations by substituting unregulated inputs for regulated ones, thus increasing their effective effort. As a result, individual fishers tend to use a combination of inputs that do not necessarily minimise costs for the level of catch. Consequently, net returns to the entire fishery are not maximised.

Evidence of this effect in the northern prawn fishery is illustrated in Kompas and Che (2002) where it was found that changes to the input control system introduced in the fishery in the early 1990s resulted in a drop in technical efficiency and considerable effort creep. It was also found that the new set of controls introduced in 2000 are likely to increase technical efficiency, but not to constrain effort as fishers are likely to substitute unrestricted inputs for the restricted input (gear length).

Effectiveness of the buyback scheme

- The effectiveness of the buyback scheme in the northern prawn fishery needs to be viewed over both the short and long term. In the short term, the scheme was effective in removing capacity from the fishery, with the maximum number of boats reduced from 302 in 1985 to 137 in 1995. This possibly resulted in some stock recovery and increased net returns over what they would otherwise have been. In the long term, however, an increase in effective effort from effort creep followed the first buyback scheme and further restructuring was required in 1999.
- Despite a reduction in the size of the fleet in the northern prawn fishery, effective effort has increased steadily in response to continually improving harvest technology and a rise in the use of unregulated fishing inputs. Recent stock assessments continue to indicate that tiger prawn stocks are overfished (Taylor and Die 1999; Die and Bishop 1999; Dichmont et al. 2001). Tiger prawn catches in recent years (2694 tonnes in 1997; 3250 tonnes in 1998; 2986 tonnes in 1999; and 1943 tonnes in 2002) are well below the estimated maximum sustainable yield of around 4000 tonnes a year.
- While the scheme used a tender system, the reserve price became known to the industry and subsequently became the floor price for all unit purchases. In effect the buyout price constantly lagged the market price. This dramatically increased the cost of the voluntary adjustment scheme. Buybacks therefore need to operate at arms length from industry to ensure this does not occur.
- While the buyback scheme was successful at removing capacity, subsequent management of the fishery led to the erosion of many of the benefits. This resulted in a need for further structural adjustment in the fishery.

South east trawl fishery

The fishery

The south east trawl fishery is one of Australia's oldest commercial fisheries. Although some processing facilities and export markets have been developed, the fishery continues to supply the bulk of market requirements for fresh fish in New South Wales, Victoria, Tasmania and South Australia.

The bulk of the catch consists of twenty species or species groups managed by quota. However, over a hundred species of finfish and deepwater crustaceans are commercially caught. The major species landed (by gross value) are orange roughy, blue grenadier, ling, tiger flathead and silver warehou. Many of the fish species caught in the south east trawl fishery are also caught in other Commonwealth and state fisheries and by recreational fishers. The three types of trawl method used are otter board, Danish seine and midwater trawl.

Following the inclusion of the east coast deepwater zone fishery from the 2000 fishing year, management boundaries for the south east trawl fishery now extend from a line east from Sandy Cape in Queensland to a line from Cape Jervis in South Australia. The fishery also includes waters around Tasmania from a distance of three nautical miles offshore (the limit of the state managed waters) to the 200 nautical mile limit of the Australian fishing zone.

The volume of catches in the south east trawl fishery have fluctuated in recent years, primarily reflecting fluctuating orange roughy catches. The catch of blue grenadier has also increased substantially since the mid-1990s. Until the mid-1980s total south east trawl fishery landings were dominated by catches taken off New South Wales and eastern Bass Strait. However, during the late 1980s and early 1990s, increased targeting of orange roughy and blue grenadier in waters around Tasmania brought about a marked increase in Tasmanian and Victorian landings. More recently, the downturn in orange roughy catches has resulted in increased effort in the shallower waters of the south east trawl fishery. Major ports for landing quota species are Port Melbourne, Ulladulla, Devonport, Eden, Lakes Entrance, Portland and Hobart (Smith and Wayte 2001).

The real net returns to the south east trawl fishery for the period 1996-97 to 2001-02 show that net returns to the fishery (including management costs) are estimated to have averaged around $2.0 million a year. In 2000-01 and 2001-02 real net returns were estimated at $2.5 million and $0.5 million respectively (Galeano et al. 2003).

Management arrangements and fishery status

Until the late 1970s the fishery was primarily based on inner continental shelf species and its management was undertaken by the states. The expansion at this time into deeper grounds off the continental shelf margin and midslope resulted in part of the fishery coming under Commonwealth jurisdiction. In 1985 the fishery was formally brought under Commonwealth legislation with the release of the South East Trawl Management Plan.

Vessel unitisation was introduced in 1986 through the establishment of a boat unit register for hull and engine units. The unitisation allowed the development of a boat replacement and upgrading policy in which boat units could be transferred and operators could purchase units to cover the units of the proposed replacement vessels plus a proportion to be forfeited to counter the increased fishing power of the replacement vessel.

Unitisation and the boat replacement policy failed to slow the rapid growth in fishing power as smaller vessels were purchased by other operators and used to introduce larger vessels. The rapid expansion in orange roughy catches and the decline in gemfish catch provided the rationale for the introduction of total allowable catches (AMC 2000).

The south east trawl fishery is currently managed using a combination of individual transferable quotas and input controls (limited entry, mesh size and area restrictions). ITQs were initially introduced for the trawl capture of eastern gemfish in 1989. In 1992 the use of ITQs was extended to cover a further fifteen species. At this time, operators were only allowed to lease quota on a seasonal basis to other operators within the fishery and the sale of quota was prohibited. Full and permanent transferability of quota has been permitted since January 1994. Under the ITQ system, each quota species is subject to a total allowable catch apportioned between the operators who are entitled to fish. The total allowable catch is set each year by AFMA.

Objective of the adjustment

The structural adjustment program in the south east trawl fishery was implemented in the wake of the allocation of individual transferable quotas. One of the primary reasons for implementing ITQs was to address the overcapacity of the fleet. In this sense the adjustment was partly structural and partly to compensate fishers who had their fishing operations affected by the move from input based units to output based ITQs (AMC 2000).

Many operators were surprised and aggrieved by their quota allocations and numerous appeals and court challenges followed (AMC 2000). Opposition to the quota regime was not relieved after an internal and external review and reallocation of ITQs. Litigation on aspects of the initial quota continued, with industry uncertain about the stability and security of the ITQ management arrangements. A review of Commonwealth fisheries by the Senate Standing Committee in 1993 found that there were inequities in the original allocation in the south east trawl fishery, and unless addressed urgently, would continue to hinder the development of a satisfactory management regime. It was recommended that AFMA consider adjustment options including buyouts and buybacks.

The buyback therefore had two purposes: first to reduce the overcapacity of the fishery, and second, to remedy the opposition over the initial allocation of quota and facilitate the change in the management of the fishery.

The South East Fishery Working Group recommended targeted financial assistance and fishing permit buyout of $6.9 million, to be funded from the National Fisheries Adjustment Program ($5.4 million) and from direct government budget appropriations ($1.5 million).

Extent of effort reduction

When ITQs were introduced there were 137 vessels licensed to operate in the fishery. By 1997, 109 vessels were in the fishery. This was thought to be excessive by an Adjustment Working Group established by the Minister, who considered that 'there is significant over-capacity in the SETF and agrees with the general industry view that around 30 per cent of effort should be removed' (*Report of the South East Fishery Adjustment Working Group*, November 1996). Following acceptance of the report by the Minister, a buyout scheme was initiated.

The scheme was to purchase up to 50 permits, covering both active and latent effort. Latent effort or capacity refers to licences that are not utilised in the fishery, but have the potential to become active without any restrictions. A fixed price system was used such that $25 000 was received per permit surrendered plus an additional 10 per cent of the value of the associated quota up to a maximum of $75 000 per permit.

Twenty-seven operators elected to sell their fishing permits to the buyout, and payments under the buyout totaled $1.7 million. Of the twenty-seven permits retired, several vessels remained in the fishery attached to different permits, either with a new owner or fishing with a different permit issued to the same owner. Operators often had multiple licences to fish in a number of the southern fisheries. When these smaller fisheries were amalgamated into the south east trawl the permits were not retired, resulting in operators having multiple licences.

The buyback also retired six latent permits not attached to any vessel, with no associated reduction in effort. Therefore, only fourteen active permits were retired under the scheme.

Effectiveness of the scheme

- At first glance it appears that the buyout scheme in the south east trawl fishery was relatively ineffective. The design of the scheme meant that little active effort or capacity was removed from the fishery.
- However, recent work suggests that a productivity increase occurred as a result of capacity reduction and that the introduction of the ITQ management regime has allowed the productivity improvement to be maintained. The net effect was to increase the expected profitability in the fishery, as reflected in the value of boat licences to participate in the fishery that rose from $60 000 to $85 000 immediately following the licence retirement (Fox et al. 2004). That is, despite the amount of latent effort surrendered to the scheme, there is evidence to suggest that the combination of the buyback program coupled with the move to ITQs has reduced effort in the fishery and increased returns to the remaining operators.
- As indicated in table 1, buyback programs will have no impact on fish stocks or the sustainability of the fishery in an output controlled fishery with individually assigned rights. The program will encourage resources to move to more efficient operators improving the financial returns of those who remain in the fishery; however, stock improvements will only result from changes to the TAC.

Southern bluefin tuna fishery

The fishery

Southern bluefin tuna is a highly migratory species that is widely distributed throughout waters of the southern oceans, including the Australian Fishing Zone. The key areas where southern bluefin tuna is caught are the Great Australian Bight and waters off south eastern Australia. Management of the global southern bluefin tuna fishery is undertaken by Australia, Japan and New Zealand under the Commission for the Conservation of Southern Bluefin Tuna. The commission sets the total allowable catch and determines national allocations for its member countries. In 2003-04, the TAC for Australia's domestic fishery was 5265 tonnes.

The Australian domestic southern bluefin tuna fishery is managed through output controls (ITQs) allocated as statutory fishing rights (SFRs) under the Southern Bluefin Tuna Fishery Management Plan 1995. In what represents a significant structural change in Australia's southern bluefin tuna industry, most of the quota is now held by fishing operators in the Great Australian Bight who catch juvenile tuna for aquaculture operations in the Port Lincoln area of South Australia.

Introduction of ITQs

In the early 1980s it became apparent that stocks of southern bluefin tuna, fished mainly by Japan, Australia and New Zealand, were fully exploited and in danger of collapse and that economic returns to operators were shrinking. ITQs were introduced to the Australian fishery in 1984. According to Geen and Nayar (1988) the fishery was well suited to an ITQ system as it was targeting a long lived, single species and there were few market outlets that would require monitoring. Quota units were initially assigned to fishers using a formula based on their vessel value and boat catch history. Once allocated, quota holders were then free to lease or sell their quota. Initial allocations to individual fishermen were on average 40–60 per cent of their catch over the qualifying period (Pascoe et al. 2002).

In the first two years following the introduction of ITQs there was a rapid adjustment of effort. Just under two-thirds of operators (with an initial allocation greater than 5 tonnes, around 5 per cent of the average initial allocation) left the fishery during this period. They accounted for around a third of total quota holdings; their lower initial allocation had averaged 31 per cent of that of remaining vessels. Of the 82 vessels that left the fishery in the first two years, 34 had not fished in the year immediately prior to initial quota allocation because of poor fishing prospects (Campbell et al. 2000). Therefore, their exit from the fishery removed underutilised capacity.

The first vessels to exit tended to require the least modification to operate in other fisheries. For example, the New South Wales fleet consisted typically of medium size vessels, which also operated in the south east fishery most of the year, only switching over to the southern bluefin tuna fishery for a relatively short time. It was therefore relatively easy for them to sell their southern bluefin tuna quota and return to the south east fishery full time. The quota holding of New South Wales operators decreased from 14 per cent to 4 per cent of the

national share between 1984 and 1994 whereas that of South Australian operators increased from 65 per cent to 87 per cent (Campbell et al. 2000).

The South Australian vessels tended to be larger with more specialist gear, giving them greater leverage to buy quota from less specialist boats leaving the fishery. The Western Australian share of the quota fell from 19 per cent to 8 per cent as operators already working in other fisheries took the opportunity to sell their quota and concentrate on those activities, thus causing a spillover effect elsewhere (Campbell et al. 2000; Pascoe et al. 2002).

In the eleven years from 1984-85 to 1995-96, Australian catch quotas were reduced by 75 per cent. However, the gross value of the fishery increased significantly, with much of this increase in value resulting from cooperation between the Australian and Japanese industries.

If the ITQ system had not been implemented it was estimated that, by 1986-87, fishing would have stopped off New South Wales and been greatly reduced off South Australia and that smaller fish would have been targeted in Western Australian waters, yielding an unsustainable annual profit of $1.6 million to the Western Australian fleet. However, under the ITQ system it was estimated that operators were earning $6.5 million a year and the average size of fish caught would have increased by 11 per cent (Geen and Nayar 1988). This last benefit stems from the need to maximise profit obtained from limited quota, thus operators targeted larger fish to benefit from their higher sale value. This also stimulated the move toward longlining, as opposed to purse seining or trolling, because of its more selective targeting of larger fish. An increasing proportion of Australian quota has also been used to develop tuna farming.

Since their initial introduction, ITQs have provided other benefits to tuna fishers. Operators were able to take advantage of the quota system to negotiate with the Japanese industry. Australian fishers were able to lease quota to Japanese longliners for a value far in excess of the profit the quota would have yielded if it had been taken directly. These arrangements also provided for the transfer of technology in longline fishing techniques and handling fish for the sashimi market. The successful venture of growing tuna in pens was also the result of joint Australian–Japanese collaboration (Campbell et al. 2000).

Extent of effort reduction

The introduction of ITQs in the southern bluefin tuna fishery in 1984-85 resulted in a substantial and almost immediate restructuring of the fishing fleet. By the end of the first season, ITQs attached to all but three of the 26 New South Wales boats and all but 21 of seventy Western Australian boats had been sold. Virtually all of this quota was sold to South Australian based fishers and even in that state there was some consolidation, with the number of South Australian quota holders dropping from 40 to 30 (Pascoe et al. 2002).

Effectiveness of the scheme

The southern bluefin tuna fishery was, in just about all respects, ideal for management through ITQs because it was a single species fishery with a single breeding stock, it had

been the subject of many years of intensive research so that the knowledge necessary to set realistic TAC was available, and there were a small number of market outlets from which to monitor catch information.

Among the factors that combined to force this rapid restructure were:

- a reduction in the TAC meant that tuna fishing was no longer viable for some fishers, while others needed to buy quota to maintain their viability
- the price difference between small and larger fish meant that quota was generally worth more to those targeting larger fish
- the continued absence of surface schools from the New South Wales fishery meant that there was little point in these fishers retaining quota
- many operators fished tuna only on a seasonal basis and had other fisheries in which they could transfer operations (Pascoe et al. 2002).

East coast trawl fishery

The fishery

The east coast trawl fishery is Queensland's largest commercial fishery in terms of value, production and geographic distribution. It extends from the tip of Cape York along the eastern seaboard to the New South Wales – Queensland border.

The fishery is predominantly a commercial one and, in general, there is limited overlap with other fisheries. The exception is blue swimmer crab — a commercial pot fishery that takes 183 tonnes a year, with a further 200 tonnes estimated to be taken annually by the recreational sector (Zeller 2002). Bay prawns are also taken recreationally in the inshore and near shore areas. Quantities caught by Indigenous fishers are unknown but are believed to be restricted to inshore prawn species only.

By the 1950s, a prawn fishery using otter trawl had developed in Moreton Bay. The fishery continued to expand northwards along the coast with sequential discoveries of fishing grounds off Bundaberg, Gladstone, Yeppoon, Mackay, Bowen and Townsville. Since the fleet was targeting mainly banana prawns, it was possibly the schooling behavior of the species that led to the discovery of these more northern grounds. Records of the earliest signs of temporary localised stock depletion date back to the late 1950s, when fishing declined significantly off Bundaberg after a few good seasons. However, it is likely that the high interannual variations in banana prawn numbers and major impediments to river flows may also have contributed to this phenomenon (Huber 2003). Diversification commenced in the fishery in the mid-1950s, with the discovery of scallop grounds off Bundaberg. This was followed by a further offshore expansion because of the discovery of eastern king prawn grounds in deeper water (Huber 2003).

Management arrangements and fishery status before the structural adjustment scheme

From the mid-1950s to 1979, the fishery fleet continued to expand until it reached approximately 1400 vessels. This expansion was driven by the emergence of lucrative export markets for prawns and scallops into Asia and greater offshore capabilities through technological advances.

In September 1979 the Queensland Government announced a moratorium on any further entry into the fishery and moved to reduce the total number of vessels in the fleet. The Commonwealth continued to license new vessels for operations in Commonwealth waters (that is, outside three nautical miles from the territorial sea baseline) until December 1984. From the late 1970s to 1999, Queensland managed the fishery through a range of input controls. In June 1987, Queensland took over responsibility for the management of the waters outside three nautical miles (apart from tuna species) under the Offshore Constitutional Settlement arrangements.

Management of the fishery has been on the basis of input controls (primarily limited entry. As was the case in the northern prawn fishery, input controls often have an impact on nominal effort. However, operators are likely to accommodate the additional constraints by improving the efficiency of their operation or by input shifting to circumvent the restrictions.

Objective of the structural adjustment scheme

Despite a cap on vessel numbers in 1979 and other input measures, fishing effort in the fishery continued to increase. In particular, there was a dramatic increase during 1986–88 when the '2:1' boat replacement policy that required two vessels to be retired for a new vessel to enter the fishery, resulted in smaller vessels being replaced with larger, more efficient vessels. The catching power of the fleet also increased through technological improvements in engine design. By 1996, effort in the fishery had peaked at around 108 000 fishing days. The fishery showed signs of being 'fully exploited' (if not overexploited), with declining catch rates for some species (such as scallops) and the serial depletion of fishing grounds (Huber 2003).

There was also a significant overcapitalisation of the fleet and declining profitability of operators in the fishery (Huber 2003). Despite these signs, and calls from some groups (such as the Great Barrier Reef Marine Park Authority — GBRMPA) for major reductions in fleet size and fishing capacity, a management plan (East Coast Trawl Plan) was introduced for the fishery in November 1999, which consolidated the then management arrangements without any effort cuts. At the time, there was reluctance to implement measures that were needed to reduce effort.

Changes to management arrangements

Following major criticism of the East Coast Trawl Plan by the GBRMPA and intervention by the then Commonwealth Minister for Environment and Heritage, the Queensland government re-examined options for effort reductions. During early to mid-2000, future

management arrangements (including the feasibility of a structural adjustment scheme for the fishery) were assessed and a stakeholder working group was established by the Queensland Premier. The group's task was to consider ways to give effect to the agreements reached at the 28th Great Barrier Reef Ministerial Council in 1999. Subsequently, agreement was reached between the Commonwealth and Queensland governments about essential changes to the management arrangements for the fishery.

The revised trawl plan set a maximum number of fishing days to be allocated in the fishery, which was equivalent to the 1996 level of fishing. The implementation of the voluntary structural adjustment scheme resulted in the removal of nearly 100 licences from the fishery. This amounted to an effort reduction of nearly 11 per cent of the allocated fishing days. In addition, industry had agreed to a mandatory 5 per cent fishing day reduction across the board in lieu of its contribution to the structural adjustment scheme. Thus, there was an upfront reduction of nearly 16 per cent of fishing days at the start of the revised trawl plan.

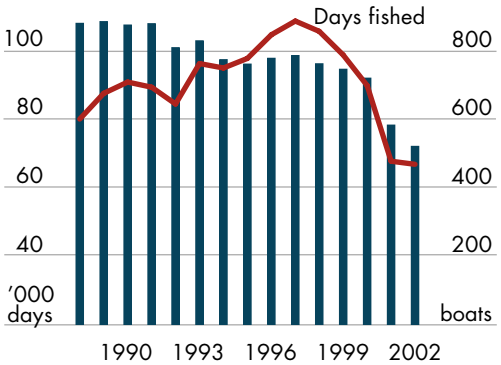
The revised trawl plan for the fishery allocated effort units based on the product of historical participation in the fishery (allocated fishing days) and the standardised hull units of the vessel. About 3.5 million effort units were allocated at the beginning of 2001.

In addition to the overall effort cap in the fishery, a second effort limitation related to the Great Barrier Reef World Heritage Area. The Australian Government contributed $10 million to the structural adjustment package in return for assurance from the Queensland Government that effort would not increase in the World Heritage Area. Subsequently, effort in the region was capped at about 2.4 million effort units.

Extent of effort reduction

The combination of the structural adjustment scheme and the penalties designed to control effort creep resulted in a 14 per cent reduction in effort after the first year. This was in addition to the 5 per cent surrendered by industry in lieu of its contribution to the adjustment scheme and above the estimated 11 per cent. According to the Queensland Fisheries Service, 493 241 effort units were removed from the fishery in 2001. This reduction in effort also brought about the removal of 237 trawlers from the fleet. Ninety-nine licences were bought out by the scheme and a further 138 operators surrendered their trawl endorsements as a result of selling their effort units. Unlike the south east trawl and northern prawn fisheries, a competitive tender system was used to ensure that vessels were retired at least cost.

B Annual number of reported days fished and number of reported vessels



The historical fishing effort in the fishery, expressed as days fished, and changes in the total number of vessels since 1988 are

shown in figure B (*source*: CFISH database). Reported effort increased from 1988 to 1997 where it peaked at 108 530 days before a rapid decline. This decline can be attributed to a combination of the vessel replacement program, vessel buyback scheme, effort unit trading system and the cap on total effort (Queensland Fisheries Service 2003).

Until the restructure in early 2001, the fishery had an average annual production of around 11 000 tonnes and an average annual estimated value of nearly $130 million (Williams 2002). Some 850 boats fished in total about 100 000 days a year. Following the licence buyback the fleet size decreased to about 530 boats. This resulted in a lowering of annual production and GVP for the fishery in 2001 to 7500 tonnes and $95.5 million respectively (Huber 2003).

With a reduction in the number of operators in the fishery and greater profitability for those that remained in the fishery, it was anticipated that the fleet would be upgraded over time. Mechanisms were built into the trawl plan to address effort creep, which was estimated to average 3 per cent a year. Operators now are required to surrender 10 per cent of their transferred effort units on trading. Similarly, a 5 per cent penalty on effort units applies to the transfer of a licence (except for a transfer from a deceased estate).

Under a third mechanism, operators need to surrender effort units on boat replacement. The amount of effort units that are forfeited depends on the size of the replacement vessel, as specified in schedule 5 of the trawl plan. The Queensland Fisheries Service has indicated that 3 per cent of effort was removed in 2001 by these three mechanisms. Huber (2003) notes that while effort creep occurs across the fleet through enhanced technology, only those operators wishing to trade or upgrade vessels pay the associated penalties. As a result, this arrangement may act as a disincentive to an autonomous fleet restructure.

The funding for the structural adjustment package was to be shared between industry and the state and federal governments — with contributions of $10 million each. However, the industry agreed to surrender an extra 5 per cent of days to secure an extra $10 million of government funding in lieu of its contribution to the package.

Unlike other buyback schemes where a fixed price was given to operators surrendering their licences, the east coast trawl fishery buyback used a competitive tender. A competitive tender requires operators to submit an offer to the scheme. These bids are then compared against a reserve price. Operators are paid their bid and not the reserve. This method can result in a lower cost paid to reduce effort. In addition, information other than price can be elicited from operators to enable further discrimination between the bids.

Effectiveness of the scheme

- Ninety-nine licences were bought out by the scheme and a further 138 operators surrendered their trawl endorsements as a result of selling their effort units.
- According to the Queensland Fisheries Service (2003), the total catch of principal fish has significantly decreased following the introduction of the trawl plan and the structural adjustment of the fleet in 2001.

- Mechanisms were built into the trawl plan to address effort creep and effort was capped at 1996 levels. This should sustain some of the benefits generated by the buyback program. However, a degree of effort creep is inevitable and as with all effort controlled fisheries, mangers will need to continually adjust the management arrangements in response to effort creep to ensure that the economic benefits of adjustment are maintained.

Discussion of case studies

The structure of Australia's fisheries has been evolving over time as both the nature and extent of fishing effort and the structure of fishing fleets respond to economic, management and environmental pressures. Induced structural adjustment through changes to fisheries management, or through buyback schemes, have been used with varying success.

Compared with the rapid restructuring that occurred in the southern bluefin tuna fishery, restructuring in the south east trawl fishery was relatively slow. Part of the reason for this was that, until all the appeals and court challenges to the quota allocation in the south east trawl fishery were resolved, permanent quota transfers (as distinct from quota leasing) were not allowed. It may be expected that, until a well functioning market developed, with many species under quota and the fishery covering such a large area, that the transaction costs associated with buying quota were substantially greater than for a system covering only a single species. The establishment of an effective quota market is a way in which the government can speed up the adjustment process without committing funds to buying back vessels.

However, it may be the case that the rapid rate of adjustment in the southern bluefin tuna fishery was exceptional. For example, a comparatively slow rate of adjustment was observed when ITQs were introduced into New Zealand fisheries (Pascoe et al. 2002). Unless there is a significant reduction in the total allowable catch, profitability in the fishery may not change greatly. This is especially the case in the south east trawl fishery where the majority of quota limits are not binding. However even when the quota is binding, if there is not another fishery in which the vessel can be used, an operator must consider not only the return that can be obtained from the sale of quota, but also the capital loss associated with the sale of a vessel without fishing rights. In such a circumstance, a rational fisher will delay selling quota until the boat is at or near the end of its economic life, provided that variable cocts are being covered.

The experience with buyback schemes in the northern prawn fishery has highlighted the need to ensure that the overcapacity problem is addressed, so that the remaining capacity is controlled. Effort creep has been a continuous problem in the fishery and has reduced the benefits of the vessel buyback schemes. While there was an initial decline in effort in the northern prawn fishery brought about by the buyback program, the decline only lasted a few seasons because of effort creep.

Although the licence buyback in the south east trawl fishery removed a large amount of inactive effort, evidence suggests that the scheme has had some success. The buyback in 1997 in the fishery resulted in productivity growth in 1998 and, coupled with the more

extensive trading of ITQs, solidified the gains. Evidence thus suggests that buyout schemes combined with a substantive output controlled management device can be effective at both reducing effort and increasing returns to operators (Fox et al. 2004). However, if the scheme had targeted active effort and the current total allowable catches were binding, the impact would have been greater.

The more recent package implemented in the east coast trawl fishery in Queensland had several benefits over some of the other schemes. First, the use of competitive tendering ensured that vessels were removed at least cost. Second, an attempt to control effort creep was made through a series of penalties associated with trading effort units, and vessel upgrading. However, the long term success of this program is not known at this stage.

The fundamental lesson from the case studies is that capacity problems originally exist in fisheries due to the historical management regimes and the associated economic incentives they created. Unless these underlying incentives to create overcapacity are addressed, any benefits of structural adjustment schemes, on both fish stocks and economic rents, will be short lived. The primary role for government is to design and implement a management regime that address the incentives that lead to capacity problems and facilitates autonomous adjustment.

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