
Fisheries management report

Use of market mechanisms for the allocations of commercial fishing access entitlements in Western Australia

prepared by
Economics Consulting Services Pty Ltd

Fisheries management report No. 2



FISHERIES
WESTERN AUSTRALIA

Fisheries Western Australia

April 1998

ISSN 1329 7902

FOREWORD

There are fish resources off the coast of Western Australia which, as yet, have not been exploited. Even once these resources are discovered and the idea of exploitation is raised, there remains the question of how access to these resources will be allocated – both initially (under the soon to be released Fisheries WA Developing Fisheries Policy) and (if any differently) in the longer term.

To date, the Government has used a range of methods for allocating such resources in the past, but each method has raised questions such as the equity of the allocation mechanism, the return to the State, and so forth.

There are also a number of fisheries where arrangements to access the total available catch have not yet been finalised or where the management rules allow for the cancellation of units of entitlement upon conviction of a fisheries offence. In cases such as these, the options for allocating these units or re-introducing them into the fishery need further exploration.

Because of these and other emerging allocation issues, Fisheries WA engaged Economics Consulting Services Pty Ltd to prepare a report on the use of market mechanisms for the allocation of commercial fishing access entitlements in Western Australia. The result is this document, “Use of Market Mechanisms for the Allocation of Commercial Fishing Access Entitlements in Western Australia”.

The purpose of the report is to assist in any future debates about the various methods of allocation available, and it is intended as an information document. The views in this report do not represent current Government policy. Moreover, it is unlikely that market mechanisms are to be used in allocating access in existing fisheries.

Feedback on the ideas outlined in the report would be welcome. These should be directed to:

Director, Strategic Planning and Policy
Fisheries WA
3rd Floor, SGIO Atrium
168-170 St George's Terrace
PERTH WA 6000



P P Rogers
EXECUTIVE DIRECTOR

12 February 1998

THE PURPOSE OF THIS PUBLICATION

This publication has been prepared as a discussion paper on the potential use of market-based mechanisms for allocating commercial fishing entitlements in Western Australia. The aim has been to explore alternative mechanisms for allocating entitlements and the circumstances under which various methods might be more effective.

ACKNOWLEDGEMENTS

Assistance, advice and information was afforded by many individuals and organisations during this project, for which ECS wishes to express grateful appreciation.

ECS is particularly appreciative of the work completed by Dr Paul McLeod from Economic Research Associates, Mr Peter Millington and Dr Rebecca Metzner from Fisheries WA.

Contents

EXECUTIVE SUMMARY	ii
1. THE MANAGEMENT OF FISHERIES.....	1
1.1 Introduction	1
1.2 Background	1
1.3 The Role of the Government.....	1
1.4 Management Options.....	3
2. MARKET PROCESSES	10
2.1 Introduction	10
2.2 When Do Markets Work?.....	10
3. FISHING RIGHTS	12
3.1 Introduction	12
3.2 Property Rights in Fishing.....	12
3.3 Fishing Licences as a Form of Property.....	13
3.4 Fisheries Rights in Western Australia.....	14
3.5 Who Holds Rights?	16
4. THE APPLICATION OF MARKET MECHANISMS IN WESTERN AUSTRALIA.....	18
4.1 Introduction	18
4.2 Potential Allocative Mechanisms.....	18
4.3 Factors Affecting the Choice of an Allocation Method.....	21
5. WESTERN AUSTRALIAN CASE STUDIES	25
5.1 Fully Allocated Fisheries.....	25
5.2 Partly Allocated Fisheries	25
5.3 New Fisheries	26
6. A MARKET-BASED DEVELOPMENT PROCESS FOR NEW FISHERIES	29
6.1 Introduction	29
6.2 The Parameters of a Workable System.....	29
7. BIBLIOGRAPHY	34
APPENDIX 1 FURTHER COMMENTS ON AUCTIONS AND DESIGN.....	35
TABLES	
Table 1: Taxonomy of Fisheries Management Systems.....	6

EXECUTIVE SUMMARY

Introduction

The paper examines the potential use of market based mechanisms for allocating commercial fishing entitlements in Western Australia. The aim has been to explore alternative mechanisms for allocating entitlements and the circumstances under which various methods might be more effective.

The role of government in fisheries management arises from the need to protect the natural resource and secure sustainable harvests and a desire to enhance the economic value of the fishery. As in other parts of the world, most fisheries in Western Australia commenced as open access fisheries. This arrangement has almost universally led to over-exploitation of the stock.

The problem for any government is that over-exploitation may lead to a collapse in both fish stocks and the financial status of those who have invested in the industry. When combined with the potentially long term environmental consequences of over-exploitation, there is considerable pressure on government to ensure fisheries are managed in a way which avoids the adverse consequences of an open and unregulated fishery.

As the range of controls over the fishing industry has increased in complexity, issues of efficiency and cost effectiveness in management have become important. Economists argue for a greater use of market mechanisms in management as a way of optimising the allocation of the scarce resource, ensuring its efficient use and thereby maximising the benefit to the community.

The appropriate policy mix can only be determined when a government's objectives are explicit. This report is based on four assumptions as to government objectives: sustainable management, environmental protection, safety and enforceability, and cost recovery.

Achieving these objectives involves determining an acceptable harvest regime and a method by which that harvest regime is to be implemented and enforced. Alternative methods for achieving these outcomes can be based on direct administrative intervention or the use of market mechanisms.

Use of **administrative processes** to determine the initial allocation provides considerable flexibility for the government agency as manager. It also facilitates tight control by the regulator and allows a wide range of public issues to be taken into account.

However, in existing systems, initial allocation by administrative decision has caused concern. In particular it has been queried because of the windfall gains created for the initial allocatee. The profits are generally capitalised into subsequent purchase prices or secondary market transaction fees thus raising serious questions of equity. With the initial recipients having the

potential to become 'price winners' there will be considerable pressure placed on the decision makers. This can place politicians and public servants in a difficult position.

Markets

Markets are generally regarded as very effective in the efficiency with which they allocate resources to the people or organisations which value them most highly. However, markets do not always work well, sometimes producing equity outcomes that are not supported by the community. However, this does not necessarily invalidate their use.

The relevant question is the extent to which 'market failure' occurs and if failure is occurring, what level of government intervention is justified to correct the failure. Government intervention, like market failure, has a price. The central issue is whether the cost of the cure is worse than the cost of the problem.

An important aspect of using market mechanisms in resource allocation is to recognise when less than perfect conditions may exist and to design the market system to allow for this.

Lotteries of various kinds have been used for university places, airwave spectrum licences and even green cards for migrant access to the United States. One objective in using lotteries appears to be equity of opportunity. This arises when there is excess demand and other rationing devices, including market price, are thought to have systematic bias in favour of particular groups. A lottery for a portion of places may produce a more equitable distribution of intake but again produce windfall gains for the prize winners.

From an economics point of view, lotteries have little to recommend them for fisheries given the general lack of well-defined socio-economic objectives in managing fisheries.

Auctions have been used successfully in many resource industries. Auction systems have been developed for pollution permits, airwave spectrum licences, petroleum leases, water rights and timber harvests. From an economic perspective auctions have several advantages including economic efficiency, revenue generation and self selection.

Where fisheries are concerned we can identify several key issues in auction design. In essence these all relate to the specification of property rights that the resource owner thinks is appropriate and the form that post auction management, including the operation of the secondary market, will take.

In looking at any fisheries, the auction does not necessarily have to be specified as a fixed quota. It could be an auction for a total quota share (eg - five per cent of allowable catch) as determined through a subsequent management plan. This approach is used as a way of allocating dam capacity in irrigation where annual water availability will vary.

Whether this works for new fisheries will in part depend on the likely variability in the allowable catch and on whether a certain minimum catch needs to be allocated to the developer to secure

associated investment such as on shore processing. One advantage of the proportional quota allocation is that the total allowable catch can subsequently be modified without a serious risk of claims for compensation.

Market Mechanisms in Western Australian Fisheries

Fully Allocated Fisheries

Most fisheries in Western Australia are fully allocated and variation in aggregate catch quota is best handled with the accepted industry participants. The emphasis in this situation needs to be on the secondary market to ensure that a management plan and property rights regime exists for the fishery.

Partly Allocated Fisheries

Partly allocated fisheries provide some scope for market-based approaches. These can arise in a number of situations. The most common is probably when commercial development and research identify a substantially larger sustainable catch than has been allocated. Another situation, such as in the Bremer Bay and Esperance Zones of the South Coast Managed Purse Seine Fishery, is an intentional under-allocation in the initial fishery management plan.

The most suitable method of allocation in situations such as these will depend on the expectations of the existing participants, legal precedent and any obligations entered into by the government. Where existing participants have a valid claim over additional allocations, administrative and non market-based processes are the most appropriate approach. However, this will raise equity concerns with the granting of potentially valuable rights to the group of existing participants.

Where the Government has intentionally allocated a smaller catch volume, and participants have no reasonable claim to extra catch, a market mechanism is the most appropriate approach provided the conditions for effective competition apply. This means there must be enough bidders to provide competition in the allocation process and they must have enough knowledge of the fishery to be able to place a value on the allocation. It is also essential that rights be fully transferable and that the conditions exist for the operation of an efficient secondary market.

Situations can occur where catch quota is forfeited in a fully allocated fishery. This could arise, for example, because a participant retires in a fishery where quota is non-transferable. Forfeited quota may allow for a new entrant without adversely affecting the position of incumbents. It is more akin to a partially allocated quota than to a variation in aggregate catch quota. As such it could be dealt with in a similar way - disposed of by way of the market process provided there is competition for it.

New Fisheries

The development of new fisheries provides a more likely scenario for the use of market mechanisms. By definition, new fisheries have not been developed because the expected rewards

do not justify the level of investment required. In financial terms, the development of new commercial fisheries is high risk in nature and the rewards need to be high to encourage investment in stock and market development.

Western Australia has a vast coastline and an extensive offshore area. While the fishing industry is well developed, there is almost certainly the potential for some new fisheries in the future. If these potential fisheries are to be investigated and developed, the government needs to provide a legislative and economic framework which supports development.

The use of a market mechanism, in the form of an appropriately designed auction supported by a secondary market, has significant efficiency and equity advantages over purely administrative arrangements. By confining the 'market' to access, the government can create the kind of property rights necessary for an efficient market without compromising its ultimate ability to control the harvesting of the resource from an ecological perspective. By making the attributes of the access right clear, the government can create an environment in which a pioneer can undertake the initial investment and bear the initial risk with a clear understanding of the expected return.

However, in order for a market-based approach to be successful certain conditions must be met. Of particular importance is the number of participants and the degree of competition. There needs to be a sufficient number of traders so that the market outcome cannot be unduly influenced by the actions of a single trader.

Unfortunately where new fisheries are concerned, this will not always be the case. The exact approach - balance between use of the market and use of direct intervention (negotiation) will have to be decided on the circumstances. Two general cases illustrate the point.

Case One: One Developer/Pioneer, One Long Term Harvester

This may arise because there is only one company or individual interested in developing a particular fishery or because, given the development costs, only one initial development role is feasible. In this case, an up-front auction or other market-based approach will not be effective given the lack of likely competition.

An alternative approach is to contract the developer to undertake the initial work in return for an access right that is defined in terms of a catch allowance over a period of time or a fully transferable catch allowance. The catch allowance can be defined in absolute or share terms but if in absolute terms must be able to be varied over the period to be consistent with the sustainable catch levels.

The combined catch allowance and period of time should be such as to allow a reasonable rate of return on the initial expenditure. The level of investment will determine the combination of catch level and time period required. The developer will have to take some risk that the required catch level will not eventuate but presumably will make an assessment based on expected success.

If the commercialisation of the fishery requires investment in shore-based facilities then this will influence the investment value and the property right (combined catch and time frame) needed to secure an adequate rate of return. This will need to be accounted for in the design of the process.

With transferability, the licence has a capital value and over time a capital gain which will be in part due to the addition of catch quota to the initial quota. A royalty could be charged that would be based on a small ongoing royalty plus a share of any capital gain in the value of the licence at the time of sale. Taking a share of a capital gain is used in some mineral areas (such as petroleum resource rent taxes) and in capital gains tax.

Case Two: One Developer/Pioneer, More than One Long Term Harvester

If the sustainable catch proves sufficient for additional commercial entrants, then the agency would be in a position to determine rules, as part of the management strategy, regarding the additional participants and their access to the catch. It could be auctioned. However, the success of this depends on there being sufficient bidders to make such a market place effective. This can only be decided at the time and consideration will need to be given to the incumbent who may have an advantage in a bidding process. If the market lacks enough competition to deliver meaningful prices through an auction process with an up-front payment then a royalty would be more appropriate.

As with the first case, if the developer has a right to catch over a period sufficient to justify the investment, there is an issue as to what happens to this quota after this. One possibility is that the total catch could be auctioned at this point (developer quota plus any incremental quota) with the developer allowed to bid. Again this will only work if there are sufficient bidders. In this case the pioneer needs to be given a bid advantage in the process to recognise the pioneer role. A form of auction as discussed previously may be appropriate. For example, the developer may be allowed a right of first refusal on their initial allocation at the lowest of the other bid prices.

To improve the process the initial quota should be transferable. In this case the auction sets a market value for the developer quota and this could be sold into the commercial market once this is established. Presumably the developer could also bid for the additional quota but with no pioneer bidding rights. There would be a complication in that the commercial value of the initial quota could turn out to be in excess or less than that assumed in the initial contract. If it exceeds it the developer has a windfall gain, if it is less the developer has a loss.

It must be recognised that developing a new fishery is risky. In the event that the required catch quota agreed to as part of the developer's access right is not realised, the developer has lost out on a part of the investment. The expected returns will not justify continuing and the developer presumably will abandon the exercise. This is a normal part of developing new business opportunities and needs to be recognised as such in the process.

The granting of pioneer rights to a developer will rarely be straightforward. Usually some one will have a claim that they have "fished" the area that the developer proposes to investigate. Rules will be needed to deal with this. These prior rights may be the result of bycatch or

indigenous rights. Ideally some catch history would be relied on to prove prior rights. If a sufficient catch history was available then some provision in the process will need to be made.

A possibility exists that a developer will seek a developer arrangement and then fail to use it. In this case the developers could lose their catch allocation which could be made available to anyone else who wished to take over the role. One way of ensuring that some development is honoured would be to make the developer rights fully transferable. Another would be to require a development bond as part of the above process. This should not be necessary if government costs are being recovered and there is no significant outstanding cost to the community from a cessation in activity. Given the risks involved in new fishery development, this situation is likely to be a common result but the community has still gained from the research undertaken and knowledge created.

1. THE MANAGEMENT OF FISHERIES

1.1 Introduction

This discussion paper has been prepared for Fisheries Western Australia by Economics Consulting Services. The work was undertaken by Murray Meaton and Dr Paul McLeod from Economic Research Associates.

The paper examines the potential use of market based mechanisms for allocating commercial fishing entitlements in Western Australia. The aim has been to explore alternative mechanisms for allocating entitlements and the circumstances under which various methods might be more effective. In considering these methods the paper considers the allocation of new quota where a new resource is being developed and the allocation of subsequent quota where additional resource is to be allocated in an established fishery.

1.2 Background

The traditional approach to the allocation of commercial fishing entitlements has been through a government administration process based on an applicant's previous fishing history, participation in the fishery under consideration and forecast ability to operate effectively in the fishing enterprise. Use of past fishing history has been an element in securing acceptability for the process. However, a strong reliance on catch history in the allocation of new rights can cause a variety of implementation problems related to catch verification, particularly in new areas where activity has been unregulated and probably spasmodic.

Fisheries Western Australia is examining market based systems as a possible alternative method that could provide a more uniform and potentially more efficient approach in the management of fisheries. This could improve the equity aspects of allocation and provide revenue for improved management of the fishing industry.

1.3 The Role of the Government

The role of government in fisheries management arises from the need to protect the natural resource, secure sustainable harvests and to enhance the economic value of the fishery. As in other parts of the world, most fisheries in Western Australia commenced as open access fisheries. This arrangement has almost universally led to over-exploitation of the stock. Economic theory can show that this is a logical outcome for participants in a competitive, open-access fishery to exploit the resource as quickly as possible before other participants do.

The problem for any government is that over-exploitation may lead to a collapse in both fish stocks and the financial status of those who have invested in the industry. When combined with the potentially long term environmental consequences of over-exploitation, there is considerable pressure on government to ensure fisheries are managed in a way which avoids the adverse consequences of an open and unregulated fishery. In an open access fishery, the financial incentive for fishermen to maximise

catch interferes with the activities of other fishermen to the detriment of all. This is termed an 'externality' because it affects other community members but is not a short term cost to the fishermen. The presence of such externalities provides the central justification for governments to become involved in fisheries management.

The general approach adopted by governments to overcome these problems has been to convert open access fisheries into limited entry fisheries with a licensing approach. To ensure a managed harvest, licences utilise a variety of controls. Some of these are input controls (eg gear restrictions to limit fishing effort) and some have involved output controls (eg individual catch quota).

In addition to regulating access, governments have taken a lead role in fisheries' scientific research. Research is critical to understanding fisheries and determining sustainable yields. It is also important in achieving an understanding of the broader marine environment in which the fisheries survive and which needs to be protected.

As the range of controls over the fishing industry has increased in scope and complexity, issues of efficiency and cost effectiveness in management have become important. Economists have argued for a greater use of market mechanisms in managing fisheries as a way of optimising the allocation of the scarce resource, ensuring its efficient use and thereby maximising the benefit to the community.

Government policies for the management of a fishery need to take into account these varying issues - achieving sustainable harvests and doing so in a way that is efficient and equitable.

The actual policy mix that is appropriate for a government to adopt can only be determined when the government's objectives and underlying reasons are explicit. This report is based on the following four assumptions as to government objectives:

1.3.1 *Sustainable management*

We assume the government and the community want to see fisheries managed in a way that ensures sustainability. Management must take into account commercial exploitation, active and passive recreation and environmental and bio-diversity protection.

Commercial fishery development provides opportunities for investment, job creation and, potentially, export income. Furthermore, under the United Nations Convention on the Law of the Sea, a nation also has obligations to develop and manage its fisheries or to allow other nations to exploit the resources it cannot or chooses not to use. This places some pressure on the nation to develop or effectively relinquish fisheries resources.

In addition to conventional commercial exploitation there is also commercial exploitation connected to recreational fishing and in many cases passive recreation such as diving.

To responsibly manage a fishery resource a government will need to ensure it is exploited, for whatever purpose, in a sustainable way such that all beneficiaries can continue to enjoy the benefits into the future.

1.3.2 *Environmental protection*

Beyond the sustainable harvest or use issue there is a wider environmental protection issue. Government needs to ensure that the harvesting and other commercial activities do not damage the marine environment. Protection of the marine environment is essential because it is the natural infrastructure upon which the fish stock and therefore the various commercial fishing activities that use the stock depend.

1.3.3 *Safety and enforceability*

Having elected to manage a fishery, a government has a responsibility to enforce the management rules to ensure that the outcome is sustainable. It also must ensure that the fishing practices adopted are safe for those involved and for any third parties affected by the activity.

1.3.4 *Cost recovery*

A government has a responsibility to its taxpayers to ensure any industries supported by the government produce long term benefits to the community.

For fisheries, such benefits may arise through commercial exploitation, recreational use or environmental preservation uses or a combination of all of these. An increasingly important issue is the extent to which the various beneficiaries should contribute to management costs.

Where commercial operations are concerned, government has accepted the notion of cost recovery based on a premise that the fishery has some capacity to pay out of private economic benefits achieved within a reasonable period of time. The actual extent of cost recovery varies across existing fisheries reflecting the perceived capacity to pay.

Where new commercial fisheries are concerned there is a view that these must be developed on a cost recovery basis. New fishery development may require considerable initial research work to assess the fishery and the sustainable harvest. This may all be done by the industry proponents in which costs are internalised to the industry. Alternatively it may be carried out by the government in which case the issue of cost recovery of research expenditure arises.

The minimum requirement accepted for the purpose of this report is that a new fishery supported by the government must appear to provide the potential for net community benefit within a limited period of time. While it is impossible to be precise about the duration of this period it is unlikely that much in excess of five years would be supported given that those investing in the industry are likely to seek a similar period of cost recovery.

1.4 Management Options

The three most common management objectives expressed in the literature are:

- the conservation of fish stocks;

- an economically efficient industry is one in which the harvest levels and fishing methods used maximise net community benefits; and
- regional development and social stability encompassing employment retention and growth.

The different objectives can produce different levels of fish harvesting. The first objective is generally met with a catch level defined as maximum sustainable yield (MSY), while the second relates to the principle of maximum economic yield (MEY).

Achieving these management objectives essentially evolves around determining an acceptable harvest regime, along with a method by which this can be implemented and enforced. The debate regarding alternative methods of achieving these outcomes centres on the use of direct administrative intervention, as opposed to the use of market mechanisms.

Administrative approaches include controls over areas, fishing methods, catch levels and other dimensions of the fishery activity.

It is important that the potential externalities associated with fishing activity are recognised and dealt with administratively.

Market mechanisms, on the other hand, are premised on the concept of creating appropriate economic incentives for individual and company behaviour to take account of any potential externalities in their decisions. In this way the externality is internalised into the decision making and socially optimal fishing outcomes are achieved. In an unregulated fishery, over-exploitation generally leads to a request for government intervention, usually aimed at restricting fishing effort and access. This is justified on the grounds that the market has, or will, fail to provide a sustainable level of exploitation. The government restrictions have generally focused on removing the fishery from open market transactions rather than any attempt to improve the operations of the market.

Markets are a mechanism for exchanging goods and services. They only operate efficiently when the goods and services being exchanged can be clearly defined so that each party is aware of what is being exchanged and is able to place a value on it. Thus, central to the debate on markets is the concept of property rights. It has been established that the absence of property rights is the fundamental aspect that results in open access (unregulated) fisheries being overexploited.

Authors such as Scott (1993) and Edwards (1994) suggest that in the future, fisheries will be managed by placing more emphasis on property rights instead of the traditional regulatory approach. This is consistent with the greater use of market mechanisms in management.

The specification of property rights in relation to fisheries and whether they can be specified appropriately is central to the choice between the two broad approaches that can be taken in fisheries management - market-based management or direct intervention. The debate revolves around four main questions (Charles, 1992):

- Who owns the fishery?

- Who should control access to the fishery?
- What is the most desirable philosophy of fisheries management?
- What role should be played by government in the fishery?

These questions concern issues of legal, historical, and/or *de facto* ownership, access and control. They need to be resolved as part of any mechanism to manage fisheries. In addition a distinction needs to be made between open access (unregulated, no defined property rights) and common property ownership (defined communal property rights).

Common property ownership defines the ownership group within which internal rules of operation of the jointly owned resource must be determined. Resources managed by a group could prevent market failure through the development of:

- informal property rights;
- territorial use rights;
- informal contracting; and
- development of co-operatives.

Proponents of common property ownership argue that the encouragement of such arrangements may be more cost effective, easier to enforce, and superior from a socio-economic perspective than alternative regulatory methods of controlling access and harvesting in an otherwise open access fishery.

1.4.1 Systems of Fisheries Management

Systems of fisheries management can be categorised into three main categories based on the extent to which the system incorporates property rights and the source of ownership (see Charles, 1988, 1992, and Edwards, 1994). The classification is shown in Table 1.

Where access is uncertain (the property right is poorly defined) such as in limited entry schemes, the individual participants do not have a basis for entering into mutually beneficial contractual arrangements with each other to adjust the management of the fishery. As a consequence, government is usually left with the role of allocating fishery resources through its regulatory powers.

Direct regulatory involvement has resulted in governments being in a situation where they are under considerable pressure to provide increased access to fisheries. Access decisions thus tend to be in response to socio-political pressures, biological or technical standards and demonstrated historical or cultural associations (Wilks and Morris, 1990). The long term community benefits receive a much lower priority with allocations being reactive and not designed to accommodate the changing demands of users. It needs to be emphasised that in this circumstance, it will frequently be the case that the

allocation fails to maximise the benefits to society and is therefore less efficient than could otherwise be the case.

The literature suggests that by defining the rights of each user group more precisely, a system of management based on the use of market mechanisms (based on mutually beneficial contractual arrangements between participants) can be used to allocate resources more efficiently. In other words, providing a defined and exchangeable access right will allow a market to operate which will produce an efficient outcome. Five management systems in Table 1 fall into this category: quotas, Individual Transferable Quotas (ITQs), concessionaire scheme, common ownership, and co-management, all rely on an appropriate definition of property rights. Each extends property rights to fishers but does so in different ways and to varying extents. Each facilitates participants entering into mutually beneficial contractual arrangements (eg the purchase and sale of individual quota, the rental of harvest rights by a concessionaire to a harvester) with each other that will improve overall efficiency.

Table 1: Taxonomy of Fisheries Management Systems

Type	Characteristics
<i>1. Private Ownership</i>	Ownership rights are held by a private firm or industry.
<i>2. State Ownership</i>	
Sole Ownership	All fishing activities dictated by Government as sole owner.
Limited Entry Schemes	Access and withdrawal rights restricted by the government (may involve non transferable quota).
Quota	Market-based system of management. State confers on fisher an exclusive right to catch a quantity of fish.
Individual Transferable Quota	Exclusive quota is made transferable via a market to other participants including potential new entrants.
Co-management	Management system based on negotiation. This will involve the participants and the State as the custodian of the fishery.
Concessionaire Schemes	Access rights granted by the State to firms who in turn provide access for various groups in return for a fee or a right to recover costs.
<i>3. Common Ownership</i>	
	Resource owned and managed jointly by a small group of self-governing fishers. The State would grant this group joint or common ownership. Each participant in the fishery then depends on the arrangements or rules worked out in the ownership group

Individual Transferable Quotas

In the development of property rights for fishers the economics literature has focused on the development of a system of well defined and tradeable shares known as Individual Transferable Quotas or ITQs. The introduction of ITQs into fisheries enhances three particular characteristics of a property right: exclusivity, transferability and duration. It is argued that granting fishermen an exclusive,

tradeable right to a quantity of fish for a known period has the potential to improve the economic efficiency of the allocation amongst fishermen through the use of market transactions that distribute the available quota allocations between the competing fishermen. This is because the permits will be traded until those valuing them most acquire them. In this situation, the highest net value to society is likely to result as it can be shown that the person prepared to pay the highest price is the one who can produce the greatest output per unit value of input effort.

In any market, the efficiency of the outcome depends on the costs associated with establishing the relevant contracts for trading the product or service and monitoring, policing and enforcing, usually through the courts, the contracts. Collectively these are known as the transactions costs and will apply to the use of transferable quota as they do in other markets.

The use of transferable quota is now well established as an element of the management of commercial fisheries. Some proponents of transferable quotas have gone further and advocated that a system of tradable shares could be introduced for all those granted access to the fish resource - both the commercial and recreational sectors. The effect would be to have both commercial and recreational individual quota units. Quota could be traded within each group or between groups. In theory this would not only facilitate the adjustment of quota within the commercial sector but also between the commercial and recreational sectors.

On the grounds of likely high transaction costs it has been argued that extending the idea of transferable quota to the recreational sector is not generally feasible. The argument is that the cost of monitoring individual angler's catch against quota and policing contracts to exchange quota between individuals would be prohibitive where the number of recreational fishers is large. It would be very costly to conduct a process of negotiation and exchange of quota among all users because recreational fishers are widely dispersed and value the resource in many different ways (Wilks and Morris, 1990). Notwithstanding this, the use of transferable quota for recreational fishers has been used in some jurisdictions and the issue is primarily one of practicality. To some extent it will depend on the willingness of the government to support this approach and to facilitate the trading process, especially where transfers between the commercial and recreational sectors are involved.

It is important to recognise that the introduction of market transactions based on ITQs does not require the government to relinquish the fundamental right to control the resources or to assert state ownership of the resource. The property right created relates to access to the stock and the right to exploit the stock as a result of that access under criteria and rules defined by the property right.

The success of market mechanisms based on ITQs is dependent upon a number of pre-requisites (Edwards, 1994), including:

- the ability to divide the fishery into separate units;
- the ability to freely trade user rights;
- many separate owners to ensure competitive behaviour; and

- owners having sufficient knowledge and finance to manage their holdings in accordance with the objectives of the management regime for the fishery.

Some commentators (Scott, 1993) have suggested that ITQs could be the precursor for assigning broader private ownership rights to individuals, including the right to manage stocks. This approach would have most application to sessile, near-shore fish resources such as abalone and oysters where the confined nature of the fishery would allow the private owner to police the property right. Such an approach would be the result of a conscious design decision in the establishment of the market regime and the associated property rights. It does not automatically or necessarily occur in an ITQ system.

Concessionaire Scheme

Under a concessionaire scheme the government grants access to a private entity such as a charter boat operator or fisherman operating in a particular location, and they in turn provide access to various user groups in return for a fee. There are a number of advantages in a concessionaire scheme (Wilks and Morris, 1990) including:

- those who seek the concession could bid for it and thereby generate resource rents;
- conservation objectives could be achieved by attaching special conditions of resource use to the concession - and thereby internalising costs that might otherwise be ignored; and
- concession holders would have an incentive to assist in the exclusion of persons trying to gain access to the resource illegally in order to protect the value of their concession.

Achieving these advantages could significantly contribute to the efficiency with which a resource is managed. However, it is important to note that under a concessionaire scheme, the government still retains the right to make the allocation decision – ownership of the resource is not transferred.

The government supports a range of concessionaire schemes such as the operation of facilities in national parks.

Common Ownership

There are numerous examples around the world where fish stocks and other common pool resources have been successfully managed and shared between users under a system of common ownership with no formal government intervention (Edwards, 1994). Individual use rights are derived from membership in the community and are associated with rules that are usually implicit, social and culturally based. Most of the fishing communities which operate in this way are small, are comprised of relatively homogenous participants and are insulated from a large market economy. Informal contracting works well in homogenous groups to the extent that participants regulate their own gear and/or even protect the rotation or assignment of favoured fishing locations. However, they do not usually control effort or catch to protect the size of stock itself (Scott, 1993). They tend to confine their rule making and enforcement to the simple problems of the manner of fishing although the total amount of the catch is controlled in some cases.

Once users with widely differing interests and perceptions of their access rights enter the fishery, the system of common ownership and co-operation tends to break down because the once commonly accepted rules are no longer accepted by all participants. History has shown that the system of common ownership also tends to succumb to market forces, especially if the common owners do not have exclusive rights to the resource. When product prices rise, or fishing technology improves, pressure emerges to change the way of exploiting the resource. 'Outsiders' with potentially conflicting goals move in and compete with the traditional users and traditional users themselves may adapt their catch behaviour under the influence of technology.

Co-management

As with any management arrangement, there are a variety of types of arrangements which constitute a co-management system. The major characteristic of the co-management model is that the management decisions about resource protection and harvesting are made jointly by the government and participants in the fishery, although the government retains the right to compulsorily reduce capacity in a fishery.

One of the most common co-management arrangements is the situation where the state retains ownership of the fishery resource but the role of allocating resources is delegated by the government to an appropriately structured group of participants. For this to be successful, participants rights must be sufficiently well defined so as to allow a process of consultation and compensation to occur between the participants.

Co-management must operate with well-specified processes whereby each of the participants and the government have a well developed framework within which they operate and exercise their rights. Management plans and the Management Advisory Committees which are a feature of several Western Australian fisheries are an example of co-management. The management plans are developed with the formal involvement of industry participants and define the rules, processes and responsibilities that are used to determine the management of the fisheries.

The co-management mechanism will tend to shift resources to those who value them most, provided participants are given an enforceable, exclusive right (Edwards, 1994).

2. MARKET PROCESSES

2.1 Introduction

Market mechanisms are a well-established vehicle for achieving efficient outcomes providing certain conditions are met. For the allocation of fish resources, market mechanisms can apply to the initial allocation of resource in a new fishery, to the allocation of additional resource in the case of an under-allocated fishery and to the re-allocation of resource between competing fishery participants.

While the most suitable market mechanisms will vary between these cases, the general advantage of the market approach is that it offers policy makers an approach to allocation that does not rely on administrative processes and does not require continuous direct intervention by policy makers to adjust the system to changing circumstances. As a general proposition the main administrative effort needed for market systems, and a critical element in their success, is the initial design of the system.

While markets are generally regarded as very effective in the efficiency with which they allocate resources to the people or organisations which value them most highly, markets do not always work well. Moreover they can produce equity outcomes that will not necessarily be supported by the community. This chapter looks at the conditions needed for an efficient market based allocation system for fisheries.

2.2 When Do Markets Work?

The theory of market effectiveness assumes that the interaction of self-interested consumers with profit maximising firms or individuals will produce the most efficient allocation of resources. The process involves those wishing to consume goods and services or resources bidding for them or the right to access them. Their willingness to purchase reflects the value to them at the margin of the goods or services or resources or of the access right. In perfect markets the resources are allocated to those who value them most highly. Certain caveats apply to the operation of markets including an absence of the externalities, economies of scale in operation, adequate information for participants and an absence of government intervention.

The marginal valuations are interpreted broadly in that they need to capture all aspects of the value of the product or resource. Consider the example of the consumer and the exploitation of natural resources. At one level the marginal value of the resource reflects the value of the resource for consumption. However, where natural resources are concerned, consumption can be active use of the resource (eg catching and eating fish), passive use of the resource (eg observing fish in the wild) or even a willingness to pay for the resource to be preserved *in situ* (eg a willingness to pay to preserve a fish species even though no direct active or passive consumption of it is possible for the consumer). For those producing rather than consuming, the marginal value is derived from the contribution that the resource can make to profit.

Certain preconditions are associated with competitive markets. The efficiency of any particular market outcome, when viewed from the perspective of society as a whole depends on how well these conditions

are approximated in the market concerned. The ideal form of a market is perfect competition which occurs when:

- a large number of buyers and sellers exists with no individuals or groups thus able to manipulate prices;
- all firms are producing or selling homogeneous products;
- no barriers to people entering or leaving the industry exist;
- all buyers and sellers have perfect knowledge regarding quantities, prices, technologies and alternatives; and
- there is no systematic divergence between private and social valuations.

These conditions are rarely all met in practice. However, this does not necessarily invalidate the use of a market mechanism. An important aspect of using market mechanisms in resource allocation is to recognise when less than perfect conditions may exist and to design the market system to allow for this.

The relevant question is the extent to which these assumptions can be relaxed before 'market failure' occurs and if failure is occurring, what level of government intervention is justified to correct it. Government intervention, like market failure, has a price. The central issue then becomes whether the cost of the cure is worse than the cost of the problem.

While the above are the conditions usually associated with the definition of a competitive market, they disguise one of the major underlying pre-conditions - one which needs highlighting in the context of fisheries. Effective competition requires that the tradeable item can be clearly defined in such a way that there are numerous tradable units, sufficiently defined to ensure they are homogenous in nature, and that the trade in the item must be supported by an appropriate contract enforcement system. That is, there must be well defined property rights attached to the item to be traded.

Where the commodity is not a tangible good, but takes the form of an access right (as is the case with commercial fishing licences) the access right must be defined in sufficient detail that an independent valuation can be made, that it can be traded, and that any contract of trade can be enforced. The difficulty in defining the rights of indigenous peoples has been demonstrated in the United States, Canada and Australia where poorly-defined rights make a negotiation process very difficult.

3. FISHING RIGHTS

3.1 Introduction

The management of any natural resource requires that private individuals or organisations with access to the resource have these access rights defined. Where the access is to products such as timber, an ore body or stored water, the rights can be defined in a measurable way because access defines physical quantities that can be accessed. Where a right of access only, with no defined resource quantity is involved, there is a range of conceptual issues which need to be addressed.

This chapter looks at the nature of rights in a fishing context.

3.2 Property Rights in Fishing

Property rights are a powerful institutional framework which society has evolved to enable people to exploit the natural environment in an orderly fashion. They constitute an institutional framework which operates according to rules of definition and conduct. As discussed elsewhere in the report, depending on the actual management regime, these may be formal and explicit or informal and implicit.

Property rights (and the associated rules) define powers, duties and responsibilities for individuals or groups. As such they have the potential, when well defined, to enable conflicts between different users of a resource to be resolved, including resolution by market transaction involving the transfer of property.

It is important to recognise that a system of property rights is adaptive. It can be, and has been, adjusted and adapted over time to change the way that resources are utilised, presumably in a manner which is in society's best interests.

Interest in any kind of property, in the sense of the ability to benefit from it, conveys three powers or 'operational rights'. These are:

- the power to receive income from the resource through access and exploitation;
- the power to manage the resource, including changing the resource; and
- the powers of exclusion and alienation.

The right of access refers to the right to enter a defined physical domain, while the right of withdrawal or exploitation refers to the right to obtain the 'products' of a resource. The power of management refers to the right to regulate internal use patterns and to change the resource by making improvements. The power of exclusion is the right to determine who will have an access right, and how that right may be transferred, while the power of alienation refers to the right to sell or lease the rights of management and/or exclusion.

The extent of these powers determines the nature of a property right and property rights are not uniquely defined. They exist on a continuum. At one end we have open access where none of the

powers are possessed by users of the resource. At the other we have resource ownership where the right holder has all three powers to the full degree.

It is the extent to which property rights are:

- well-defined, to minimise uncertainty and provide the incentive for investment over time;
- divisible, to take advantage of the range of possible simultaneous or sequential users that may exist;
- exclusive of other users, to enable value to be captured by the owner and to control free riding; and
- alienable, to facilitate transfer to the highest value use(s);

which determines how effective any market arrangements based on these property rights will be.

Property rights are central to the management of natural resources. Historically property rights for fish or for access to the fish resource have not been well defined. As a substitute, direct regulatory control (largely input controls) was introduced as a way of pursuing sustainable harvest of the resource. It has been argued that while such direct control could approach sustainable harvests it is unlikely to give maximum economic efficiency in the sense of maximising the value of the fishery to society.

Failure to adequately define property rights in fisheries is one of the main reasons why fish resources are not exploited efficiently. The move to individual transferable quota is a move to create tradable ownership rights in fish resources comparable to those for other resources such as land. Where well defined property rights exist, then the problems of security of access, exploitation and allocation between competing users can be largely left to the market place.

3.3 Fishing Licences as a Form of Property

Property rights can be defined more completely in terms of their features. Again, the major features of property rights include: duration, exclusivity, transferability, divisibility and the power to receive income.

A fishing licence can be thought of as a form of property right. The holder of the licence has the right to use the resource by way of access and withdrawal, but usually does not hold rights to management of the resource, alienation or exclusion. These are usually reserved for the government as resource manager. A fishing licence may be better thought of as a legal right to use and enjoy the fruits or profits of something belonging to another.

In the fishing case duration refers to the period over which the right holder can profitably invest in harvesting. Exclusivity relates to the number of participants involved in the fishery. The larger the number of participants the less exclusive is the right in the sense that the individual right holder will have to contract with these participants as part of the management of the fishery. Transferability refers to the extent (number of participants and conditions) to which a right may be sold or rented.

Divisibility relates to the number of joint holders of one property right or to the subdivision of a territory. The power to earn income from the resource through access, withdrawal and transformation is also an attribute that needs to be carefully defined.

The powers conferred through fishing rights depend on the form and mix of these attributes. For example, fishing licences may be freely transferable or non-transferable. Restrictions on transfers are often part of a management regime to restrict effort over time. The effect is to weaken the powers associated with the licence. On the other hand, if a non-transferable licence was converted into an individual transferable quota (ITQ), this would strengthen the fishing right as the powers attached to the ITQ are stronger than those attached to the non-transferable licence.

3.4 Fisheries Rights in Western Australia

In Western Australia, the public's right of open access to fish stocks was first curtailed early this century, when the *Fisheries Act* was amended to make it compulsory for commercial fishers to acquire licences and abide by a variety of associated rules. Regulations gradually became more numerous and stringent in the years to follow. The concept of the limited entry fishery became relevant in the 1960s when it was introduced for the rock lobster fishery and subsequently to the state's major prawn fisheries. The next major limitation of access rights occurred in 1983 when the number of licences in all fisheries was frozen. From this time on a process of contraction and consolidation has taken place in the industry and exploitation of individual fish species has been subject to specific management rules. Upon freezing the number of licences, additional value was generated for authorisations. This reflected the value of having an excludable right to participate in a fishery. Most of the State's forty or so managed fisheries operate under limited entry schemes, with only three managed using transferable rights (ITQs).

The rights of anglers have also been modified over time by regulations on gear, closed season, times, minimum sizes, bag limits and possession limits. In addition, recreational licences have been issued for some fisheries such as abalone, rock lobster, marron and net fishing.

There is some confusion within the Western Australian fishing industry as to what rights are conveyed by a commercial fishing licence. Some participants, including financiers, are not aware that the rights conveyed by licences are substantially weaker than those conveyed by an ownership right. These misconceptions are compounded by *de facto* rights which have emerged in fishing communities where licences have been held for many years combined with the flexible nature of the current management system. The most serious misconceptions relate to the beliefs that:

- the government will protect commercial fishers' interests in fishery resources from the demands of other user groups;
- a licence provides access in perpetuity;
- the government has a legal obligation to compensate licence holders if a licence is revoked; and

- that the government has a legal obligation to pay compensation if a management plan is altered in response to biological circumstances.

The *Fish Resources Management Act 1994* outlines the extent of rights that are currently conferred by a licence. These comprise a combination of statutory rights, which have been acknowledged by legislation, and non-statutory rights which are not formally recognised but are regarded as ‘reasonable expectations’ which go along with holding a licence. In many instances, these expectations are sufficiently strong to be recognised by a court of law.

The rights inherent in the *Fish Resources Management Act 1994* in Western Australia are discussed in the following sections.

3.4.1 Rights of access and withdrawal

A licence conveys access and withdrawal rights by way of authorising its holder to take fish for commercial purposes in a particular fishery subject to regulations set out by a management plan for that fishery. The rights to manage, exclude, and alienate are retained by government. A licence is usually current for a 12-month period, after which time it is renewed subject to the fisher meeting all entry criteria.

The government’s right to manage is usually expressed through a Management Plan for the fishery. This Plan regulates the extent to which licence holders have access to the resource. For instance the plan specifies the capacity of the fishery in terms of catch and effort, the area and times of fishing, or anything necessary to ensure that the fishery management goals are met. The Plan is also used to implement and enforce the government’s rights of exclusion and alienation, thereby determining who will be granted a licence and how that licence may be transferred.

3.4.2 Right to consultation

Licence holders in a Managed Fishery (which is specifically defined in the Act), or their representatives, have a substantive legal right to consultation before any changes are made to the management plan. Certain person(s) or advisory committee(s) who have been previously nominated in the Management Plan must be consulted by the Minister **before** any significant amendment is made to the Management Plan.

3.4.3 Right of renewal

Annual renewal of fishing licences is not a statutory right but is regarded as a reasonable expectation by a court of law. Licences expire every 12 months or upon dissolution of a Management Plan. If a licence holder applies to the Executive Director for renewal of his/her licence, then the Executive Director must renew the licence subject to a range of criteria relating to offences against the *Fish Resources Management Act*, contravention of conditions of the licence, failure to use the authorisation over the past two years and the Executive Director may at any time delete or vary conditions of the licence.

A history of commercial fishing activity in a fishery prior to a Management Plan being introduced for the fishery does not confer any right to the participant that he/she will be granted an authorisation subsequent to a Management Plan being introduced. Similarly, participation in the fishery under an old management plan does not confer the right that a licence will be automatically granted under the new Management Plan. Nevertheless, past history is usually taken into account in determining allocation of licences. Furthermore, courts may regard the government's decision not to renew a licence as a breach of the holder's expectation of renewal.

3.4.4 Right to compensation

There are various government policies which aim to protect fish stocks, prevent rent from being dissipated or seek to alter the allocation of stocks amongst user groups. Common law claims for compensation where the management action is to address a biological problem are unlikely to arise, so long as due process is followed and sufficient care is taken. A case for compensation is much more likely to arise when there has been a shift in the allocation of the resource from one sector of a fishery to another, or from one sector of a fishery to an external sector. An example would be the exclusion of holders of fishing licences from an area so that it could be explored for minerals or used for other forms of development.

In situations where the agency makes the decision that capacity in the fishery needs to be reduced, the Minister may enact legislation provided by the *Fisheries Adjustment Schemes Act 1987*. Under this legislation authorisation holders have a statutory right to 'fair' compensation determined at market value for any loss suffered by cancellation of licences or the reduction of certain entitlements brought about by the Compulsory or Voluntary Adjustment Schemes.

However, technically there is no legal requirement for the government to trigger the *Fisheries Adjustment Schemes Act* and no well defined system to determine when it ought to be triggered. At present, the government has the right to revoke an existing management plan and take all licences away without compensating fishermen. Similarly, the government is not obliged to compensate licence holders if their entitlements are reduced by changes to the management plan.

Commercial fishermen have a reasonable expectation that their licence will be renewed. Therefore, if the government singled out one or more licence holders for removal by refusing to renew their licence(s), the courts would view this as a breach of the fisherman's right to renewal.

3.5 Who Holds Rights?

Rights may be considered to be held only by those to whom the government has granted access. However, there are historical reasons for recognising other right holders and there are new areas which lie outside any government-managed area over which rights are contentious.

Given the open access nature of a fishery, there is frequently a community expectation of access. Traditional access by individuals, such as indigenous people, also creates a claim on access rights. In areas which have not been declared as being under some form of management, there is little restriction on fishing activity and hence recreational and commercial fishermen may claim a right by virtue of

catch history which is almost impossible to prove. Where a new fishery is created over an area subject to past fishing for other species, a right as a consequence of past by catch may also be claimed.

If these groups have prior claims that can be justified, they may be described as having *pioneer* rights. Such rights need to be recognised in the allocation of access to new areas.

4. THE APPLICATION OF MARKET MECHANISMS IN WESTERN AUSTRALIA

4.1 Introduction

It is the attributes of the rights created for a fishery by the government that will shape the behaviour of participants in terms of their willingness to participate via investment in the fishery and the way that they manage the fishery once involved. In general the tighter and more certain is the right, the greater will be the willingness to invest and the greater will be the incentive for efficient management.

The allocation process chosen must reflect the nature of the rights being allocated or implied if the participants are to develop and operate in the fishery in an efficient and effective way. This means that the initial allocation mechanism and the methods of operating any secondary market will vary according to the particular rights assigned in any particular fishery situation.

4.2 Potential Allocative Mechanisms

In dealing with the allocation of new licences or quota there are three general approaches described in the literature. These are variously used in dealing with new allocations in areas such as timber, water, spectrum, minerals and fishing. They can be classified as:

- administrative decision,
- lottery, and
- auction.

Each has advantages and disadvantages. In addition each can be implemented in many different ways. The general advantages and disadvantages of these three approaches can be summarised as follows.

4.2.1 Administrative decision

Use of administrative decision to determine the initial allocation provides considerable flexibility for the government agency as manager. The agency would determine the criteria and rules for the allocation. It also facilitates tight control by the regulator and allows a wide range of public issues to be taken into account. Where existing participants exist, for example because of a developmental role, their rights can be protected explicitly (eg via the agency deciding to grandfather existing participants and /or their shares into the new regime).

However, in existing systems, initial allocation by administrative decision has caused concern. In particular it has been queried because of the windfall gains created for the initial allocatee. The profits are generally capitalised into subsequent purchase prices or secondary market transaction fees thus raising serious questions of equity in the sense that subsequent entrants must purchase through the secondary market without receiving any windfall gain.

In addition, it limits the flexibility of the regulator to subsequently vary access rights because of the potential loss in value to purchasers of rights in a secondary market. This is a consideration that may also apply to the other mechanisms discussed. With the initial recipients having the potential to become 'price winners' there will be considerable pressure placed on the decision makers. This can place politicians and public servants in a difficult position.

4.2.2 Lottery

Lotteries of various kinds have been used for university places, airwave spectrum licences and even green cards for migrant access to the United States. One objective in using lotteries appears to be equity of opportunity. This arises when there is excess demand and other rationing devices, including market price, are thought to have systematic bias in favour of particular groups.

For example if there are excess candidates for a particular university course at a defined minimum standard, rationing by raising the entry standard or by price may favour certain socio-economic groups. A lottery for a portion of places may produce a more equitable distribution of intake but again produces a windfall gains for the prize winners.

From an economics point of view, lotteries have little to recommend them for fisheries given the general lack of well-defined socio-economic objectives in managing fisheries. The *ex ante* equity benefit is likely to come at the expense of the *ex post* or realised equity. In addition, for fisheries, as with other resources, there are specific criteria that a prospective producer must meet (eg catching capacity/investment) and these are critical to ensuring an optimal harvest outcome. Lotteries are not favoured in this case as they produce windfall gains for winners with a potentially large number of losers unless the entry cost is high.

An efficient secondary market with the ability to freely trade the initial allocated rights should result in an efficient outcome. This is one way of allowing a market to rectify any initial inefficiencies in allocation. However, a secondary market, such as ITQs, will not always fix any initial misallocation arising from the use of a lottery. Even where a secondary market does adjust the initial allocation, the initial winner experiences a windfall gain and the government receives no revenue resulting in a realised loss of welfare for the general community.

4.2.3 Auction

Auctions have been used successfully in many resource industries. Auction systems have been developed for pollution permits, airwave spectrum licences, petroleum leases, water rights and timber harvests.

From an economic perspective auctions have several advantages. They are:

- economic efficiency - in the sense that the resource is allocated at the outset to the user/harvester who values it most so that less reliance is placed on secondary markets;

- up-front revenue generation - returning some gain to the resource owner/regulator and /or to the general community; and
- self selection - in that users participate on the basis of their willingness to pay.

While the concept of an auction is well understood, there are many variants. The ultimate success depends on the auction design and its suitability for the particular resource to be allocated. Design needs to be thought out carefully. A more detailed examination of auction methods is provided as Appendix 1 to this report.

Where fisheries are concerned we can identify several key issues in auction design. In essence these all relate to the specification of property rights that the resource owner thinks is appropriate and the form that post auction management, including the operation of the secondary market, will take.

As part of implementing an auction approach for new fishery quota, the following issues need to be resolved

- the protection of existing rights, including development rights, if any; and
- the protection of community/social rights, such as conservation objectives, including the ability to adjust catch levels if required.

In addition, there are specific auction operation issues that need attention. These are:

- the method of auction - open or sealed bids or multiple rounds of sealed bids;
- accepted auction price - first price (highest bidder), second price (second highest bidder) or last unit bidder. For example, under the last unit bidder model, the final price is determined by separating bidding for each quota unit (eg one tonne). If 100 tonnes is auctioned then the price bid for the 100th tonne quota unit sets the price. Under this approach the higher bidders (the inframarginal bidders) are all more profitable than otherwise because they pay a final price below their bid price; and
- method by which quota will be matched with capacity. This is the issue of quota aggregation. Success here requires an efficient secondary market which can adjust quota to capacity.

There are certain broad requirements of market based or auction methods for initial allocation that need to be recognised.

At the top of these requirements is the size of the quota on offer in relation to the economic size of participants and the number of participants. To obtain the benefits of competition it is important that there be a large number of units on offer and that there be a reasonable number of bidders.

If there are very few bidders this needs to be factored into the design. In the extreme case where competition for access is negligible, an administrative approach is more likely to be the most efficient.

This may be a barrier to the use of auctions to any significant extent in Western Australia. New fisheries here may be relatively small, raising the prospect of a lack of competition for access in the first instance. Where a developmental fishery is relatively small, one potential developer may be the only bidder, making an auction ineffective. In this case a tender approach is likely to be more successful if return to the community is an important criteria.

In looking at any fisheries, the auction does not necessarily have to be specified as a fixed quota. It could be an auction for a total quota share (eg five per cent of allowable catch) as determined through a subsequent management plan. This approach is used as a way of allocating dam capacity in irrigation where annual water availability will vary.

Whether this works for new fisheries will in part depend on the likely variability in the allowable catch and on whether a certain minimum catch needs to be allocated to the developer to secure associated investment such as on shore processing. One advantage of the proportional quota allocation is that the total allowable catch can subsequently be modified without a serious risk of claims for compensation.

Bidding a royalty rate is used in mining. Imposition of royalties is common for mineral extraction and bidding the royalty is simply another method of determination. Under this model, those wishing to gain access to a mineral do not have a royalty payment nominated to them. Rather they nominate the amount of royalty that they are willing to pay to the government if they are given access to the mineral deposit. The amount that they are willing to pay in royalty will reflect a variety of factors including their assessment of the quality of the resource, resource extraction costs and prices and any conditions (eg environmental conditions) imposed on the access. Where there is effective competition for the resource the amount of royalty bid will reflect the market assessment of the resource rents that can be earned from extraction of the resource.

Currently fisheries do not pay a royalty comparable to that which is paid in mining. Although fisheries management costs are subject to various degrees of cost recovery, a royalty is not a payment for access to the resource as such, but a payment to cover costs incurred by government in researching and managing the fishery. Bidding a royalty as a way of allocating new quota appears to be inconsistent with the current approach adopted in existing fisheries management where cost recovery for management services provided by government is the focus and not payment for access to the resource.

However, for some fisheries, resource rents are earned and as a consequence the issue of a resource rent charge may be appropriate. If conditions arose where there was considerable competition for access to a new fish resource then setting a royalty may be appropriate and bidding would be one way to fix the royalty rate.

4.3 Factors Affecting the Choice of an Allocation Method

A number of factors affect the choice of an allocation method. Mention has already been made of the conditions necessary for the successful operation of a market-based approach. Factors specific to the fishing industry which influence the method used are discussed in this section.

4.3.1 Allocation conditions

No matter what form of allocation system is adopted, there will be effort and hence costs associated with the administration. Essentially the allocation system will define allocations and the rules and responsibilities associated with operating those allocations. These rules must be complied with and this creates compliance costs. These compliance requirements may involve such things as management fees to cover basic research required for the fishery, notification rules for sale and transfer of quota (or other rights) and rules regarding the locations within which quota (or other rights) can be sold. For example, a licence to catch salmon on the South Coast is tied to a particular beach and cannot be transferred to another location. On the other hand a licence to catch salmon on the West Coast is not tied to a particular beach in that region but it cannot be transferred outside of that region.

The nature of these conditions have a significant influence on the value of the 'right' and hence its potential purchase and sale price.

4.3.2 Fishery knowledge

One issue that is particularly relevant for new fisheries is the issue of imperfect knowledge and uncertainty. Knowledge of a fishery grows over time as catch history is built up and this leads to refinement of the total stock and sustainable harvest estimates. As this information is acquired, changes to the Management Plan are likely to be required.

For a new fishery, the initial allocation will possibly occur when the knowledge of the resource is still uncertain. This means that early entrants, including any pioneer entrants, will bear some risk. How this risk is shared between Government and participants will be determined by the method of initial allocation and the allocation conditions.

For example, an initial allocation of an estimated sustainable yield and allowable catch based on shares and up front bidding involves risks for both parties. The actual sustainable yield may be overestimated in which case the bidders have paid more than they should have for their shares of a lower yield. On the other hand, if the system involved on going royalty payments linked to harvest values or quantities, then the payment to the government as resource owner would vary as the sustainable yield was varied and the government would bear some of the risks associated with these variations.

4.3.3 Fishery entry

Entirely up-front bids put greater risk on government and participants where the resource is uncertain. Distribution of risk depends on the nature of uncertainty as illustrated in the previous example.

One uncertainty that exists concerns the ability of the government to limit entry. Where the government cannot guarantee the limitation of the access to rights holders (eg deep water fishery with high policing costs) up-front bidding may be less useful because the bids will be discounted to reflect the uncertainty that non-rights holders will be excluded.

4.3.4 Existing rights holders

Where existing users are a small percentage of what is to be allocated, some grand-fathering of existing rights may be appropriate without untoward efficiency effects. They could then bid/apply for additional quota along with new players. Where existing entrants hold the major proportion of access rights equity issues will arise if the remaining catch rights are auctioned, for example:

4.3.5 Pioneering rights holders

Where there are pioneering fishing rights, some protection of such rights will almost certainly be necessary if lengthy legal action is to be avoided. Recognition and protection of such rights might be based on:

- allocation of a portion of overall quota, or of a quota share directly to developers/pioneers; and/or
- allocating some of the quota or quota shares to developers/pioneers as 'designated bidders'. Only they can bid for this portion of the allocation.

Before a system can be implemented it is critical to determine the objectives of the process (efficiency, equity, conservation, revenue). The auction approach places a high emphasis on economic efficiency. However, these other issues still need to be addressed in the design process.

It was pointed out initially that auctions are used extensively. Auctions have been used for allocating defined broadcast spectrum, timber auctions for defined packages of timber (harvested or standing), cash bidding for oil permits for defined areas, airport landing rights, operating licences (transport systems, wastewater treatment plants etc), and water rights. In these areas the auction is favoured for the initial allocation from an efficiency standpoint because the 'product' on offer is relatively well defined. Design of an auction system must account for the definition of the attributes of the item to be auctioned.

4.3.6 Initial versus secondary market

No matter what form of mechanism is used for the initial allocation, an important influence on the efficiency of the resource allocation outcome is the operation of the secondary market.

For example, an initial allocation may be by administrative decision but that allocation may be transferable. This occurs in some water jurisdictions. 'First in time, first in right' water allocations are often freely transferable as water entitlements. As a consequence the initial and final allocations can vary significantly. This is because the initial allocation under the 'first in time, first in right' model may provide water rights to individuals with a low willingness to pay for water. They are then likely to sell their right in the secondary market to someone with a higher willingness to pay. Through this process the water is allocated away from the initial recipients.

Many resource management and allocation systems have placed more reliance on the secondary market than on the initial allocation as a means of securing resource allocation efficiency.

Transferable quotas and water entitlements are cases in point. The initial allocation of water and fish resources has historically been by administrative rule and much of the policy work has been to define the associated property rights in terms of the subsequent right to transfer and trade. One reason for this is that the mix of social and political forces, including in many cases legal constraints, combine to influence the initial allocation process away from a strict economically efficient outcome.

However, it needs to be recognised that a fully functional secondary market will not necessarily rectify fully any misallocation or inefficiency established in the initial allocation process.

This will depend in part on how efficiently the secondary market can be organised and the transaction costs involved. If, for example, initial water allocations were to small landholders, it may involve substantial transaction costs to collect parcels of water together to achieve an aggregate allocation capable of sustaining a major new development.

5. WESTERN AUSTRALIAN CASE STUDIES

5.1 Fully Allocated Fisheries

The pressures on government to increase the allowable catch in a fishery are substantial both from existing operators wishing to expand and from other fishermen wanting to gain access. With frequently static, or even declining prices in real terms, and rising costs for inputs such as labour and fuel, existing operators seek a higher catch allocation to improve productivity and hence maintain profitability. This pressure applies whether the allocations to individual fishing operators are in absolute terms or in terms of a share of the allowable catch.

For these reasons, it is common for developed fisheries to be fully allocated, in the sense that the aggregate catch is equal to the estimated sustainable yield. However, this does not mean that there will not be adjustments. There can be variations in approved aggregate catch volumes based on variations in the estimated and forecast resource stock levels. These fluctuations will be reflected in allocations to fishing rights holders and are a feature of normal fishery management. Where the allocations to operators are for defined amounts, these will need to be adjusted. Where they are in share terms, adjusting the aggregate allocation automatically adjusts the amount available to the individual operator.

The important point is that, for a fully allocated fishery, we can interpret such adjustments as being adjustments around a more stable long term sustainable harvest.

It follows that for a fully developed fishery there is very little scope for the allocation of rights to new entrants. New entrants thus need to rely on the secondary market for access. If a natural increase occurs in potential harvest volumes, existing fishing rights holders may expect that the additional volume will be allocated to them given that when the reverse situation occurs they will have to accept lower catch allocations. For a fully developed fishery in the sense just described, the major role for market mechanisms is in the secondary market whereby individual allocations can be traded allowing new entrants and the adjustments of holdings by existing entrants. The potential for up-front market mechanisms such as sale or auction of extra catch is limited, unless the government is prepared to pay to re-purchase rights when catch allocations need to be reduced. If the latter is to occur, access rights need to be defined in absolute rather than proportional terms.

Most fisheries in Western Australia are fully allocated and variation in aggregate catch quota is best handled with the accepted industry participants. The emphasis in this situation needs to be on the secondary market to ensure that a management plan and property rights regime exists for the fishery.

5.2 Partly Allocated Fisheries

Partly allocated fisheries can arise in a number of situations. The most common is probably when commercial development and research identify a substantially larger sustainable catch than has been allocated. Another situation, such as in the Bremer Bay and Esperance Zones of the South Coast Managed Purse Seine Fishery, is an intentional under-allocation in the initial fishery management plan.

The most suitable method of allocation in this situation will depend on the expectations of the existing participants, legal precedent and any obligations entered into by the government. Where existing participants may, for whatever reason, have a valid claim over additional allocations, administrative and non market-based processes are the most appropriate approach. However, this will raise equity concerns with the granting of potentially valuable rights to the group of existing participants.

Where Government has intentionally allocated a smaller catch volume, and participants have no reasonable claim to extra catch, a market mechanism is appropriate provided the conditions for effective competition apply. This means there must be enough bidders to provide effective competition in any allocation process and they must have enough knowledge of the fishery to be able to place a value on the allocation. It is also essential that rights be fully transferable and that the conditions exist for the operation of an efficient secondary market.

Situations can arise where catch quota is forfeited in a fully allocated fishery. This could arise, for example, because a participant retires in a fishery where quota is non-transferable. In Western Australia, the Executive Director has the power to dispose of such forfeited quota by whatever means are deemed appropriate. Forfeited catch quota may allow for a new entrant without adversely affecting the position of incumbents. It is more akin to a partially allocated quota than to a variation in aggregate catch quota. As such it could be dealt with in a similar way - disposed of by way of the market provided there is competition for it.

5.3 New Fisheries

The development of new fisheries involves a number of separate activities. These may be provided by both the government and the private sector. For example, assuming a long term objective of a commercial fishery, research is needed into fish stocks to define sustainable harvest, while market research is needed to cover processing and marketing requirements. The former is usually undertaken by government while the latter is usually undertaken by the private sector.

By definition, new fisheries have not been developed because the expected rewards from such expenditure either do not exist or do not justify the level of investment required. Expressed in financial terms, this means that the development of new commercial fisheries is high risk in nature and the rewards need to be high to encourage investment in stock and market definition.

The risks associated with new fisheries development are something that are directly affected by the approach that is taken by government as the owner/regulator of the resource. Risks can be reduced through government research and development on fish stocks and management regimes and through the definition of property rights for participants. These two factors interact to determine the level of rewards expected by the private sector investor.

The basic model suggested in this paper is based on a separation of the pioneer from the long term harvester with the major decision regarding allocation deferred until after the research stage. Under this model, a private sector pioneer undertakes research harvests for a potential new fishery, usually under some form of limited development licence, and these are assessed by the government to determine the sustainable harvest and commercial potential.

At some point in this process, a decision has to be made that there is a commercial resource and that this should be allocated. At this point the scale of the fishery needs to be assessed and an allocation mechanism designed and implemented. This could be an auction system such as those described above with provision for the pioneer to be formally recognised in the process along the lines already described.

The above approach to development has been successful in the past. However, potential new fisheries are almost certainly located further away from infrastructure than existing fisheries, or involve other factors such as deep water or a lack of proven markets, which make their development a high risk investment. It may be the case that some form of shore-based processing operation is needed in the initial stages of a new fishery's development, to make the research harvest saleable and which can be expanded if its long term viability is proven. In this case, it may not be possible to separate the involvement of the fishery's pioneer as the researcher/developer and long-term harvester. Essentially, this means that the selection process must be such that a developer and long-term harvester is selected up-front and allocated long-term harvest rights.

Long-term commercial viability presupposes that participation in the fishery will enable all harvesting and management costs to be covered. These costs include those associated with the initial research and development of the fishery. Government is commonly involved in significant aspects of the initial set-up (research and the drawing up of a management plan, etc) and it is entitled to seek cost recovery through an auction of allocated fish quota, or through ongoing management fees.

Under the second approach described above, the private sector participants will bear a higher share of research costs in return for a long-term harvesting right. The government is still entitled to cost recovery, but these costs are likely to be a lower proportion of the total.

It can be argued that full commercial viability can be best assessed if the initial research is undertaken by private companies operating under commercial discipline with government support and direction. However, as already noted, the expenditure and risks involved mean that such work will only occur if there is an adequate return from involvement. This means that some certainty about the process and the outcome will be required. This requires property rights or a strong expectation that these rights will be created in a form that will allow the required investment to be recouped. Alternatively, the initial stock discovery and delineation process could be undertaken by the private sector on a contractual basis.

If the research/pioneer harvester is a separate entity from the long-term harvester, this expectation or property right will centre on the process whereby the decision regarding size of the fishery is made, the way in which the sustainable harvest is to be allocated and the rights accorded the pioneer in regard to that process. In the second case, the property right will centre on the way harvest over and above that allocated initially to the developer will be dealt with.

6. A MARKET-BASED DEVELOPMENT PROCESS FOR NEW FISHERIES

6.1 Introduction

Western Australia has a vast coastline and an extensive offshore area under the jurisdiction of the State and Commonwealth governments. While the fishing industry is well developed, there is almost certainly the potential for some new fisheries in the future. However, the fact that these fisheries have not been developed suggests existing operators view the investment return as low, risks as high or that there are impediments to development. If these potential fisheries are to be investigated, and possibly developed, the government needs to provide a legislative and economic framework which supports development. This chapter explores the elements of a market-based regime which might encourage investment in the development of new fisheries.

6.2 The Parameters of a Workable System

Securing investment in a developmental fishery is going to be a function of the expected return which in itself may be a function of the property rights that are created as part of the process.

The general objectives of the government and the need for secure rights mean some key principles have to be met including:

- certainty of process with agreed rules at the commencement and an expectation that these will not be altered with success or failure;
- recognition of the rights of the pioneer in the ongoing management process;
- disincentives for free riding whereby those who do not contribute to development attempt to benefit from it (for example, as appears to be happening with overseas harvesters of the Patagonian toothfish);
- clear process and timetable for the development fishery to become a managed fishery with an enforceable time frame;
- new commercial fisheries to be managed on a full cost recovery basis with a predetermined and explicit timeframe for this; and
- where a new fishery is developed, access rights should be fully transferable as is the case with the current large commercial fisheries.

There are a variety of ways to satisfy the above criteria.

The first issue is the role of the developer and the creation of an appropriate right. It is doubtful if the initial commercial quota should be allocated using a market mechanism. The expected degree of

competition is unlikely to support such an approach. This being the case it needs to be recognised that the expected and necessary rewards for the initial investment must be given through access rights.

A guaranteed right of access appears the most appropriate vehicle to secure the initial developer investment. Such pioneer or priority access rights allows risk to be rewarded without a requirement for government funding.

In general, the pioneer or developer access right should be defined explicitly to ensure that the allocation is sufficient to justify the level of investment. This level will vary with the level of and type of investment.

In general the issues that will need to be specified in the property right are going to cover:

- the catch and the proportions of it that will be allocated to the pioneer and subsequently to other participants;
- transferability;
- the duration of the access right;
- the royalty regime, if any, that is to apply;
- the cost recovery basis;
- the process by which the 'commercial' potential will be decided;
- the process for dealing with the transition from a pioneer to established fishery status; and
- the sale of the catch during the experimental stage.

There are two cases which appear likely and these are discussed below.

6.2.1 Case One: One developer/pioneer, one long term harvester

This may arise because there is only one company or individual interested in developing a particular fishery or because, given the development costs, only one initial development role is feasible. In this case, an up front auction or other market-based approach will not be effective given the lack of likely competition.

An alternative approach is to contract the developer to undertake the initial work in return for an access right that is defined in terms of a catch allowance over a period of time or a fully transferable catch allowance. The catch allowance can be defined in absolute or share terms but if in absolute terms must be able to be varied over the period to be consistent with the sustainable catch levels.

The combined catch allowance and period of time should be such as to allow a reasonable rate of return on the initial expenditure. The level of investment will determine the combination of catch level and

time period required. The developer will have to take some risk that the required catch level will not eventuate but presumably will make an assessment based on expected success.

If the commercialisation of the fishery requires investment in shore-based facilities then this will influence the investment value and the property right (combined catch and time frame) needed to secure an adequate rate of return and this will need to be accounted for in the design of the process.

There are several issues that need resolution in this case.

1. Additional harvest quota but too small for additional entry

During the developmental phase, catch experience may demonstrate that additional harvest over and above the granted right will be available. The allocation of this catch will depend on the amount and the likely competition among new entrants for the rights of access. If the volume would not justify a new entrant, there is little alternative but to allocate the extra catch to the pioneer developer. The pioneer would already have a share of this catch if the pioneer allocation was in percentage terms.

However, as this is additional harvest over and above the initial allocation then some 'price' for access appears appropriate. This could be in the form of a royalty. If a royalty is charged on the incremental harvest then we have a case for also having a royalty on the initial harvest to be consistent but this would affect the combination of catch allowance and time needed to justify the investment. An agreed royalty negotiated prior to the developmental research appears the most appropriate approach.

2. Ongoing quota allocation

Under this model, the developer has been given a access right over a defined period sufficient to justify the required development investment. An issue is what happens to the quota after this. One possibility is that the total catch could be auctioned at this point (developer quota plus any incremental quota) with the developer allowed to bid.

However, this will only work if there are enough bidders to compete for the allocation. Additionally, we need to recognise that the developer may have a considerable advantage in the bidding process in the case where there is only room for one long term harvester and the developer is already the incumbent. This advantage may be even greater if the developer has invested in shore-based facilities that would then have to be used by any new player. These factors increase the likelihood that such an auction will not be effective and that a market based commercial value for the fishery will not be obtained in this way. Although full disclosure in return for the right to explore might alleviate this problem to some extent, there will be some residual advantage for the incumbent.

3. Transferable quota

One way of dealing with the above issue is to make the developer allocation fully transferable. In effect, this does away with the notion of the fixed time period. It would then attract a market value that will influence the initial contract conditions. Presumably in such a process the required allocation to

justify the initial investment will be somewhat less and the expected capital value of the licence at the time at which the fishery is declared commercial will be factored in.

By making it transferable, new players could enter when additional catch is allocated by buying some or all of the developer quota allocation, although in this case of one long term participant, we are assuming that a new player would have to buy all of it to be viable.

With transferability, the licence has a capital value and over time a capital gain which will be in part due to the addition of catch quota to the initial quota. A royalty could be charged that would be based on a small ongoing royalty plus a share of any capital gain in the value of the licence at the time of sale. Taking a share of a capital gain is used in some mineral areas (such a petroleum resource rent taxes) and in capital gains tax.

6.2.2 Case Two: One developer/pioneer, more than one long term harvester

If the sustainable catch proves sufficient for additional commercial entrants, then the agency would be in a position to determine rules, as part of the management strategy, regarding the additional participants and their access to catch. It could be auctioned. However, the success of this depends on there being sufficient bidders to make such a market place effective. This can only be decided at the time and consideration will need to be given to the incumbent who may have an advantage in a bidding process. If the market lacks enough competition to deliver meaningful prices through an auction process with an up-front payment then a royalty would be more appropriate.

As with the first case, if the developer has a right to catch over a period sufficient to justify the investment, there is an issue as to what happens to this quota after this. One possibility is that the total catch could be auctioned at this point (developer quota plus any incremental quota) with the developer allowed to bid. Again this will only work if there are sufficient bidders. In this case the pioneer needs to be given a bid advantage in the process to recognise the pioneer role. A form of auction as discussed previously may be appropriate. For example, the developer may be allowed a right of first refusal on their initial allocation at the lowest of the other bid prices.

To improve the process the initial quota should be transferable. In this case the auction sets a market value for the developer quota and this could be sold into the commercial market once this is established. Presumably the developer could also bid for the additional quota but with no pioneer bidding rights. There would be a complication in that the commercial value of the initial quota could turn out to be in excess or less than that assumed in the initial contract. If it exceeds it the developer has a windfall gain, if it is less the developer has a loss.

It must be recognised that developing a new fishery is risky. In the event that the required catch quota agreed to as part of the developer's access right is not realised, the developer has lost out on a part of the investment. The expected returns will not justify continuing and the developer presumably will abandon the exercise. This is a normal part of developing new business opportunities and needs to be recognised as such in the process.

The granting of pioneer rights to a developer will rarely be straightforward. Usually someone will have a claim that they have 'fished' the area that the developer proposes to investigate. Rules will be needed to deal with this. These prior rights may be the result of bycatch or indigenous rights. Ideally some catch history would be relied upon to prove prior rights. If a sufficient catch history was available then some provision in the process will need to be made.

A possibility exists that a developer will seek a developer arrangement and then fail to use it. In this case the developers could lose their catch allocation which could be made available to anyone else who wished to take over the role. One way of ensuring that some development is honoured would be to make the developer rights fully transferable. Another would be to require a development bond as part of the above process. This should not be necessary if government costs are being recovered and there is no significant outstanding cost to the community from a cessation in activity. Given the risks involved in new fishery development, this situation is likely to be a common result but the community has still gained from the research undertaken and knowledge created.

7. BIBLIOGRAPHY

- Arnason, R. (1993). 'The Icelandic Individual Transferable Quota System: A Descriptive Account.' *Marine Resource Economics*, 8(3):201-218.
- Berkes, F. and M.T. Farvar (1989). Introduction and overview. *Common Property Resources*. London, Belhaven Press. 302.
- Casey, K.E., C.M. Dewees, B.R. Turriss, and J.E. Wilen (1995). 'The Effects of Individual Vessel Quotas in the British Columbia Halibut Fishery.' *Marine Resource Economics*, 10(3):211-230.
- Charles, A.T. (1988). 'Fishery Socioeconomics: A survey.' *Land Economics*, 64(3):276.
- Charles, A.T. (1992). 'Fishery Conflicts; a unified framework.' *Marine Policy*, (September):14.
- Clark, I.N., P.J. Major, and N. Mollett (1988). 'Development and Implementation of New Zealand's ITQ Management System.' *Marine Resource Economics*, 5(4):325-349.
- Edwards, S.F. (1994). 'Ownership of Renewable Ocean Resources.' *Marine Resource Economics*, 9:20.
- Hardin, G. (1968). 'The tragedy of the commons.' *Science*, 162:1243.
- Johnson, R.N. (1996). 'Implications of Taxing Quota Value in an Individual Transferable Quota Fishery.' *Marine Resource Economics*, 10(4):327-340.
- National Recreational Fisheries Working Group (1994). *Recreational Fishing in Australia: A National Policy*. Department of Primary Industries and Energy.
- Schlager, E. and E. Ostrom (1992). 'Property Right Regimes and Natural Resources: A conceptual analysis.' *Land Economics*, 68(3):13.
- Scott, A.D. (1989a). 'Evolution of Individual Transferable Quotas as a distinct class of property right.' *Economics of fishery management in the Pacific Islands region*, Hobart, Tasmania, Australia, Australian Centre for International Agricultural Research.
- Scott, A.D. (1989b). 'Conceptual origins of rights based fishing'. *Rights Based Fishing*. Netherlands, Kluwer Academic Publishers.
- Seabrooke, W. and H. Pickering (1994). 'The extension of property rights to the coastal zone.' *Journal of Environmental Management*, 42(2):161.
- Wilks, L. and P. Morris (1990). 'An economic perspective for the resolution of fishery related resource allocation problems.' ABARE.

**Appendix 1:
Further Comments on Auctions and Design**

The potential to use auctions as a device for initial quota allocation has been raised in the body of the report as a method of dealing with new fisheries development. If auctions are to be used then, as pointed out in the report, much of their success will depend on the design of the system. Markets generally, and auctions in particular, are not universal panaceas for addressing allocation issues. They need to be designed to achieve the best outcome depending on the circumstances. This appendix provides some additional comment on aspects of the use of auctions.

Where a pioneering right exists that we wish to recognise, some kind of preferred treatment for the pioneer may be justified. In an auction context this will mean deeming the pioneer to be a designated bidder. This assistance to the pioneer can take several forms. A proportion of the overall catch quota could be set aside only for the pioneers who can bid as designated bidders for this portion. A proportion of the catch quota could be allocated directly to the pioneers with the remainder bid for.

By providing designated bidders with a price preference as described above, price competition between the non-designated bidders will increase as they bid for a smaller share of the aggregate catch quota. Where designated bidders are successful and obtain quota at lower prices than the quota won by non-designated bidders, the existence of a secondary market may allow windfall gains for the designated bidders. Therefore, while having a process with preferred or designated bidders can efficiently look after pioneer rights, its distributional consequences need to be considered.

In a fisheries context where the number of bidders may be relatively small, there is always the concern that market transactions, including auctions, may result in collusive activity to set price. Note that this is different from a monopoly outcome, which is not necessarily a bad outcome if the scale economies dictate that there is only room for one (or a few) operators. However, the bidding that determines the number of final operators should not be collusive even where a monopoly is the logical outcome.

Generally where there are limited numbers of bidders, open auctions provide opportunities for collusion. The offset is that they make all information on competitors' valuations available, and this may lead to higher bid prices than would be received in a sealed bid auction. The exact outcome depends on the risk-averseness of the bidders combined with the assessment by bidders of the likely fluctuations of the fish stock and allowable catch.

Sealed bid auctions can be designed to address collusive bidding practices. One consequence of this design is that these auctions tend to avoid the 'winners curse' problem where the highest bidder overestimates the true value of the quota and as a consequence pays too much for the right obtained in the auction. Avoiding the 'winners curse' is likely to be desirable because, while it means forgoing initial revenue, it also avoids having a fishing operator who is overcapitalised and who may consequently struggle financially.

Multiple rounds of sealed bids, with the bids but not the identities of the bidders being announced after each round are used as a way of achieving elements of both open and sealed auctions. The information on valuation of the quota is made available, reducing the likelihood of 'winners curse' and the opportunities for collusive practices are reduced.

An important aspect of auctions is designing the way that the final price for quota will be set. Under a first price system, the price paid is the price actually bid. This raises the prospect of the 'winners curse' such that the winning bidder may struggle to use the allocation profitably based on the prices paid for it.

An alternative is to set the price at the level determined by the second highest bid. This second price system helps avoid the downside of the 'winners curse' but may be a significant discount on the first bid price unless the bidding competition for the quotas is adequate.

A further variant is the unit or one price auction where bids are accepted for each quota unit simultaneously. If 100 units of quota are on offer then the highest 100 bids are accepted with all the successful bidders paying the lowest accepted bid. In this way, the price paid for each quota unit is determined by the successful bidder with the least profitable fishing operation and potential profits of more efficient operators are protected instead of being dissipated in quota acquisition.