INDUSTRY
COMMISSION

# COST RECOVERY FOR MANAGING FISHERIES

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# INDUSTRY COMMISSION

3 January 1992

The Honourable J S Dawkins, M.P.
Treasurer
Parliament House
CANBERRA ACT 2600

Dear Treasurer

In accordance with Section 7 of the *Industry Commission Act 1989*, we have pleasure in submitting to you the report on Cost Recovery for Management of Fisheries.

Yours sincerely

T J Hundloe

Presiding Commissioner

**COMMISSIONER**

Benjamin Offices, Chan Street,
Belconnen ACT Australia
PO BOX, Belconnen ACT 2616
Telephone: 06 264 1144
Facsimile: 06 253 1662

## Acknowledgment

Commissioner Hundloe wishes to thank staff members who assisted him in preparing this report. The staff team was led by Dr Geraldine Gentle.

# CONTENTS

# TERMS OF REFERENCE

I, PAUL JOHN KEATING, in pursuance of my powers under Section 7 of the Industry Commission Act 1989, hereby:

1. refer the question of cost recovery for the management of fisheries under Commonwealth control for inquiry and report within twelve months of the date of receipt of this reference;

2. specify that the Commission determine the major beneficiaries of management of Commonwealth fisheries, including those sectors of the fishing industry which benefit both directly and indirectly, recreational fishermen, fishing communities, fish consumers and the wider community, and the extent to which each of these groups benefits;

3. request that in making its assessment the Commission take into account:

   (a) Australia's international obligations particularly those under the United Nations Law of the Sea Convention to conserve and manage the fish resources of the Australian Fishing Zone;

   (b) the Government's fisheries management objectives of resource conservation, economically efficient exploitation and an appropriate community return;

   (c) the Government's policy that subject to it being cost effective to do so, the beneficiaries of services should contribute to the costs in proportion to the benefits received;

(d) the special circumstances existing in Torres Strait where management covers both commercial and subsistence fishermen and where special treaty obligations apply; and

(e) the Government policy of meeting the full cost of surveillance and enforcement of illegal foreign fishing in the Australian Fishing zone and of recovering the full cost of management from licensed foreign fishing boats;

4. specify that the Commission shall consider the most suitable point(s) at which cost recovery levels could be imposed, bearing in mind the extent to which the cost recovery from one sector is likely to be passed on as a cost to other sectors of the fishing industry;

5. require the Commission to report on which beneficiaries should contribute to the cost of fisheries management;

6. require the Commission to report on the average proportion of management costs that should be recovered from industry participants and that to be met by the Government for all Commonwealth managed fisheries;

7. require the Commission to identify fisheries where circumstances warrant variations to these cost proportions, and recommend appropriate variations for each of these fisheries;

8. specify that the Commission is to have regard to the established economic, social and environmental objectives of governments; and

9. specify that the Commission is to avoid duplication of any recent substantive studies undertaken elsewhere.

P.J. KEATING
6 December 1990

# OVERVIEW AND RECOMMENDATIONS

Although about an eighth of the gross value of production of Commonwealth commercial fisheries is spent annually on their management, most are over-fished and all are grossly over-capitalised. On the face of it, it appears that Commonwealth management has achieved neither of its two major objectives, sustainable use of the resource and economic efficiency within the commercial fishing industry. Other uses of the living marine environment of the Australian Fishing Zone (AFZ), including recreational fishing, have received scant attention.

Cost recovery for fisheries management services was introduced into Commonwealth fisheries in 1984. In this Inquiry the Commission has been asked to examine the question of cost recovery, to determine the beneficiaries of fisheries management and who should pay for what aspects of management, how they should pay and when they should pay. In answering these questions the principle the Commission has adopted is that beneficiaries of fisheries management should generally pay.

Many participants in the inquiry objected to having to pay for management that they did not consider to be efficient. They argued that what had been achieved had been at very high cost. This sad state of affairs was said to be due to inefficient institutional arrangements, lack of integration of research with other aspects of fisheries management, failure to manage fisheries within a meaningful ecological framework and high, uncompetitive operating costs of government agencies.

In 1990-91, about $28 million was spent by all agencies involved in the management of Commonwealth commercial fisheries. About $15 million was spent on research and about $8 million on regulation, administration, licensing, and surveillance of the commercial fishing industry. Another million dollars or so was spent by government on the management of the commercial fishing industry, particularly for rationalisation and restructuring. In addition, about $4 million was spent on exclusively government functions such as policy development, liaison with other governments, both State and foreign, and enforcement.

The Government's policy has been to recover all of the costs it incurs in the management of foreign fishing in the AFZ and 90 per cent of the costs of management of domestic commercial fishing. About $3.7 million was spent on management of foreign fishing operations in the AFZ, all of which was recovered in management fees. Less than one third of total costs incurred on domestic fishery management was recovered ($5.7 million). The apparent inconsistency with the policy of charging 90 per cent of the costs arises because fishermen have not generally been charged for research, the most costly element of fisheries management.

More cost-effective research is essential if the future is going to be better than the past. However this research has to be paid for. Fishermen, both commercial and recreational, have contributed very little to its cost. They may believe that given the relative lack of success of past management they should not have contributed much. But if fishermen want better management decisions, they will have to pay considerably more for research.

To determine who should pay for what, the Commission has distinguished those aspects of fisheries management which benefit the community generally from those which benefit particular users such as commercial or recreational fishermen. As management of the fishery resource itself benefits both the community and users, now and in the future, users and the community (taxpayers) should contribute according to the benefits they each receive.

The question of who should pay for fisheries management is not just a matter of achieving an equitable sharing of costs. What has to be taken into account are the quantity and nature of services required to achieve management objectives and the efficiency with which they are delivered. The Commission has therefore had to consider how government fisheries management agencies can perform their functions more cost-effectively. It has also looked at ways fishermen can take greater responsibility for management of their industry.

## Who should pay for fisheries management?

In addressing the question of who should pay, it should be recognised that the management of fisheries is undertaken for a variety of purposes. Fisheries management should aim to achieve optimal utilisation of the living marine resources of the Australian Fishing Zone. This involves making the best possible use of the marine environment, considering all of the values and uses to

which it can be put, from fishing of all kinds (commercial, recreational and traditional) to non-capture uses such as conservation and tourism and protection of the marine environment or particular species within it.

Within commercial fisheries, the main objectives of management are conservation of stocks to achieve sustainable yields and the efficient allocation of other resources such as labour and capital used in fisheries. It is therefore useful to distinguish two conceptually distinct elements in fisheries management - the management of the resource itself, and the management of the fishing industry. The distinction between *resource management* and *fishing industry management* allows a clearer picture of the objectives and achievements, benefits and costs of each activity. Resource management activities include research and regulation of use of the resource, while fishing industry management activities include such profit enhancing measures as rationalisation, marketing and product quality improvements and measures to reduce fishing costs.

**Fisheries resource management**

At the highest level of management of the AFZ as a whole, the tasks of resource management are to determine the appropriate rate and type of exploitation and to allocate the rights to use the resource among various, often competing uses.

The second level of resource management is management of fisheries. Efficiency of the commercial fishing industry is not the only consideration in managing a fishery. Increasingly, attention is moving from the target species alone to the ecosystem of which it is a part. The lifestyle of traditional fishermen, the interests of recreational fishermen and the tourist industries which they support, regional social impacts and concepts of equity and justice are also important. So too are other aspects of human endeavour that affect fisheries - the quest for scientific knowledge and the protection of the resources of the nation are but two of these.

Management of fishery resources entails a diverse range of activities. It requires research into the biology and population dynamics of target species and also into the ecosystem as a whole. These research findings must then be translated into operational management objectives. So must the

economics of the fishery. It requires a capacity for legislation and regulation, surveillance and enforcement. Within the complex jurisdictional arrangements of Australia's federal system, Commonwealth resource management also requires inter-governmental coordination. Resource management is therefore a function of government.

The basic mechanism for implementation of resource management is a Plan of Management. This plan should cover all activities required, including research. It should deal with all uses of the fishery, be they commercial, recreational or traditional fishing or non-capture activities such as conservation or tourism. It should include a budget for the complete management of the fishery resource in question, and a statement of sources of funds.

As much resource management benefits users of the resource, they have a responsibility to contribute towards its costs. They also should bear the costs of compliance with management plans. A significant proportion of fisheries management resources are devoted to such compliance activities as obtaining industry support for the plan, surveillance, enforcement and monitoring.

**Fishing industry management**

The task of fishing industry management is to ensure that efficient use is made of the resources used in the industry. The common property nature of fisheries, combined with the relatively large number of fishermen operating in a fishery, makes such management difficult. As market forces alone cannot ensure an efficient allocation of labour and capital to a common property resource, a major task of fisheries management is to overcome the open access problem (see Chapter 1).

The major task of fishing industry management at the Commonwealth level has been to reduce the level of effort in fisheries relative to the level which developed previously, particularly under open access. It is clear that the Commonwealth has not been generally successful at rationalising the fishing industry (see Chapter 5 and Appendix G for details). There are a number of reasons why this is the case, including opposition from fishermen, the analytical complexities involved in

determining what is the optimal level of effort (number of boats/fishermen) given the sunk capital and opportunities for other productive uses of boats and labour, the unwillingness of those involved in management to make hard decisions at the right time, and inadequate scientific knowledge of biological and ecological factors in many fisheries.

Enabling the provision of collective goods and services within a fishery is another facet of fishing industry management. In common with other industries with large numbers of firms selling homogeneous products, individual fishermen cannot retain exclusive access to the fruits of their efforts in activities such as fishery-specific research and development or training. This reduces incentives to undertake such activities. Other objectives such as coordination of fishing to reduce costs and maximise returns, by reducing gluts and shortages in the market, 'real time' management and providing a safer working environment cannot be achieved at all without collective action. If a framework can be provided for such industry management activities to be undertaken collectively for the benefit of the entire fishery, then efficiency within the fishery can be improved.

The fishing industry is overwhelmingly the beneficiary of fishing industry management and therefore should pay for it. Industry-specific management services should either be performed by the management authority on a full cost recovery basis, or handed over to the industry. With fishing industry management, the 'user pays, user says' principle should apply. In order to allow this to happen, some mechanism must be put in place to allow collective action for the provision of collective goods, and to facilitate rationalisation. Restructuring should not be underwritten or financially assisted by the Commonwealth.

Which elements of industry should pay will vary with the action undertaken. Measures relating solely to the catching sector should be paid for by that sector. Where other sectors such as processing or marketing benefit, they should contribute. Given the diverse range of potential industry management measures and the differences among fisheries, the Commission does not consider that it is feasible to predict or prescribe the proportions in which each group should pay.

Submissions to this inquiry have made it clear that fishermen are frustrated by their inability under current institutional arrangements to effectively manage their affairs. The Commission therefore proposes that the Commonwealth enable the establishment in each commercial fishery which so

desires, a body corporate to which all endorsed fishermen would automatically belong. It would be similar in many respects to the bodies corporate that manage strata title buildings. The corporation would be responsible for raising sufficient revenue to fund the whole of the corporation's activities.

This concept is being used successfully in a number of State fisheries such as South Australian Abalone, the Spencer Gulf Prawn fishery, and several prawn fisheries in New South Wales. Although the institutional frameworks are different, the Western Australian Rock Lobster fishery and a number of fishermen's cooperatives also are providing collective industry management services for their members (see Appendix H for details of co-management in fisheries).

Fishing Industry Councils at the State and National level are an important means of providing collective management services for the fishing industry as a whole. At this stage, the funding of these bodies varies from State to State, with Commonwealth fishermen generally not liable to contribute significantly. As the role of peak bodies has been formally incorporated in the new Commonwealth management framework, Commonwealth fishermen should no longer be able to free ride on their State counterparts.

## Arrangements for the future

This inquiry has highlighted many problems in Commonwealth fisheries management. They are not just of the Commonwealth Government's making. Commonwealth-State jurisdiction issues and rivalries have continued to hinder effective research and management; the Off-shore Constitutional Settlement has not been applied to the extent possible. Some of the current problems are a legacy of past management approaches; Commonwealth management is of recent origin and has had to contend with restructuring of fisheries suffering from the normal problems of historical open access. The fishing industry too must take some responsibility. Industry divisions and resistance to hard decisions have made it more difficult for governments to agree on management issues. These, and other issues, are considered in Chapters 3 and 5.

In the past, management policies and programs have been developed on the assumption that they achieve their objectives. Yet there is a very real question whether and to what extent management of Commonwealth fisheries has made the community, or groups within it, better off.

Fisheries management is an evolving area of public policy. When this Inquiry commenced, fisheries under Commonwealth control were managed by the Australian Fisheries Service, operating under legislation enacted in 1952. Now, at the completion of the Inquiry that function is in the process of being assigned to a completely new body, the Australian Fisheries Management Authority. This body will be required to function in terms of a suite of new statutes.

The new legislation has broadened the scope of fisheries management. The most significant ways in which this has been done is in the explicit requirement that fisheries management be undertaken within a framework of ecologically sustainable development and that recreational fishing becomes a responsibility of the Commonwealth in fisheries it manages.

There are potentially other important differences between the old and new. The actual nature and degree of differences will not become obvious until there is experience of the new management.

Given these changes - and the uncertainty about the future - the Commission has had to look to the past to see what lessons could be learned. It has had to consider the present to understand the existing framework for cost recovery. It has had to be mindful of what the future might bring.

The legislative changes are but one aspect of the changes under way. While they reflect to some extent changing societal demands, values and attitudes, they do not capture these to the fullest extent. There is an increasing understanding of the marine environment and concern for its long term sustainable use. There is increasing concern about how the values - commercial, recreational and amenity - of the marine environment can be adversely affected by what happens on the adjacent coast. There is greater recognition now that management of commercial fishing is only part of the broader management framework; that what happens in one part of the Australian Fishing Zone can impact on other parts and, therefore, the jurisdictional separation of powers between the levels of Government is a matter of real interest and concern.

The commercial fishing industry itself is undergoing both structural and attitudinal changes. It is involving itself more in management issues and is becoming willing and able to undertake certain management activities which are rightfully in its province. This is encouraging - and to be encouraged.

In terms of structural change there is a long way to go in most fisheries. The immediate task of management is to halt and, as quickly as possible, reverse the over-exploitation and over-capitalisation. All major Commonwealth fisheries are in a transitional phase, but each is at a different stage of moving to economically efficient, sustainable fisheries. For this reason, answers to the terms of reference to-day - particularly in terms of the costs of management, when the benefits of management will be felt, when and how they should be paid for - are very likely to be different to answers one would find when the fisheries are in a state of better economic and biological health. When this pleasant result occurs the priority of management will have changed to the easier, on-going tasks of monitoring, surveillance and enforcement. It also means that empirical evidence of the results of restructuring fisheries will be available.

The Commission proposes that in future the costs of management be paid for according to the extent to which the benefits accrue to identifiable private interests or to the public as a whole. This determines who the beneficiaries are and the proportion of management costs which should be met by the various beneficiaries. Where benefits accrue to identifiable private interests, the associated costs should be borne directly by those interests. Where the benefit accrues to the community generally, it should pay.

## Recommendations

Fisheries management should be viewed as an important component of a more general management framework directed toward managing the resources of the AFZ on a sustainable basis, and allocating access to the AFZ according to its highest use value for society. A vast array of organisations at both Commonwealth and State level presently have a role in management at this level. There is very little co-ordination. The OCS agreement has yet to be applied to its potential.

> *The Commission recommends that the Commonwealth and States accelerate the rationalization of fisheries management under the OCS, so that each fishery can be managed by a single agency.*

To a significant extent the problems facing fisheries managers to-day (as well as others responsible in a direct or indirect sense for other uses of the AFZ) can be attributed to the lack of a co-ordinated policy. In terms of the living resources of the marine environment political boundaries on the water have no meaning. Co-ordination of fisheries management (at Commonwealth and State levels) within the broader objectives and functions of resource management in the AFZ requires a new institutional framework. To this end

> *the Commission recommends that the Commonwealth and the States co-operate to establish an Australian Fishing Zone Authority.*

This would be a small body responsible to a Ministerial Council representing environmental and fisheries matters. This authority would not be responsible for operational management of particular activities such as commercial fishing.

This body would be a policy co-ordinating organisation dealing with the highest order responsibilities in the AFZ. The responsible policy and operational departments or agencies of Government would, within this co-ordinating framework, continue to perform their normal functions.

The functions of government, Commonwealth and/or State, at this level include: policy formulation with regard to such matters as ecologically sustainable development and social objectives; research pertaining to such matters; legislating to achieve these objectives; inter-governmental relationships (foreign and domestic); treaty obligations; control of foreign fishing; surveillance and enforcement to protect the AFZ; and allocation of rights to access.

All these functions are, by necessity, the responsibility of Governments. The beneficiary is the Australian people, now and in the future. As a consequence, the community should pay for these functions.

Just as co-ordination is required at the national level, so it is within the Commonwealth Government arena. The Commission has noted the division of responsibilities among the various bodies under Commonwealth control which are involved in resource management, including research. The lack of co-ordination and integration is inflating the costs and reducing the effectiveness of management.

*The Commission recommends that the respective fisheries management roles and functions of AFMA, CSIRO, BRR, FRDC and ABARE be clarified and made explicit.*

Overlap and possible diseconomies are associated with the work undertaken by the Commonwealth and State fisheries research agencies.

*The Commission recommends rationalisation of Commonwealth and State fisheries research agencies and commensurate adjustments in appropriations.*

Fisheries management overlaps with the higher order functions described above. This means that AFMA (and other Commonwealth bodies involved in aspects of managing the AFZ) will have a role in the development of resource management policies which pertain to these functions. AFMA will be involved in policy formulation and research related to that function. On the basis of the higher level policies, AFMA will determine the level of exploitation in any fishery. It will allocate rights of access to commercial and recreational fishermen and it will formulate Plans of Management for specific fisheries, in accordance with the broader objectives.

The Australian public, now and in the future, will be a major beneficiary of these specific functions undertaken by AFMA, but users (such as commercial and recreational fishermen) will benefit especially as a consequence of research which provides a better understanding of the resource and results in the subsequent formulation of Plans of Management which increase profitability and catches.

*The Commission recommends that the Commonwealth should undertake resource management of the fisheries under its control. The Commonwealth should bear the costs of those functions which benefit the community generally. Users should contribute according to the benefit which they derive from the public provision of effective resource management.*

The Commission notes that the Commonwealth Government's policy has been to recover some of the costs of public expenditure, which results in improved profitability, by the imposition of a tax on new management rents. This would provide a return to Government for the ownership of the resource and its effective management, but the Commission believes it is necessary to put in place a mechanism which would bring a more immediate discipline to decisions about Government expenditure on management activities.

*The Commission recommends that an assessment of the costs of research deemed necessary for the fishery to achieve the objective of sustainable profitability (for commercial fishing) and to meet other resource management objectives be included in each Plan of Management along with an explicit statement of how and when commercial users should pay for their share of this cost.*

*Where other commercial users, such as charter boat operators, benefit from publicly funded resource management, they should also contribute to the costs of resource management according to arrangements set out in the Plan of Management.*

BRR is probably best placed to prepare this assessment for each Plan of Management .

Recreational anglers benefit from resource management and should contribute by paying an annual licence fee. This will require joint action by the Commonwealth and States because of the inter-relatedness of inshore and off-shore recreational fishing and the difficulties and cost of policing recreational fishermen in separate jurisdictions.

*The Commission recommends that the Commonwealth and States should together implement an annual licence fee of $20 for all recreational fishermen over 18 years of age. The distribution among Commonwealth and State fisheries agencies of funds collected from this licence system should be determined by the Australian Fisheries Council.*

Another function of fisheries management to be undertaken by AFMA is the detailed management of individual fisheries under Plans of Management. The objective of this function is to benefit fishermen who are granted access to a specific fishery. For a purely commercial fishery the following functions have to be performed: administration and licensing; industry restructuring; implementation and delivery of the Plan of Management, including surveillance (but not enforcement or surveillance undertaken for national purposes) and monitoring (by logbooks or other means); and commissioned research. All these activities are tied to the Plan of Management. The beneficiaries are commercial fishermen operating in a managed fishery.

*The Commission recommends that 100 per cent of the costs of restructuring and 100 per cent of the recurrent costs of implementing Plans of Management, including administration and licensing, surveillance, as determined in the Plan of Management, monitoring, commissioned research and reviews of Plans of Management, should be paid for by commercial operators in the fishery.*

*This principle should also apply to commercial fishermen operating in the Torres Strait, unless there are overriding social objectives at stake. Where such social objectives are identified, to ensure consistency with other Aboriginal and Torres Strait Islander programs, funding should come through ATSIC rather than from appropriations through DPIE.*

The Commission has drawn attention to a third level of management, collective decision making at the MAC/specific fishery level. The Commission wishes to encourage a greater degree of 'self-management', more appropriately termed 'co-management'.

*The Commission recommends that the Commonwealth should enable fishermen within a specific fishery to provide for themselves collective fishing industry management services by allowing a body corporate to be established, if such is the wish of fishermen. All fishermen (including recreational fishermen and charter boat operators, if they were involved) entitled to operate in the fishery would automatically be members.*

In considering foreign fishing in the AFZ the Commission notes the quite significant difficulties involved in managing access to highly migratory species such as tuna. It encourages greater co-operation between the nations involved, their respective scientists and fishermen. It is not in a position to say whether or not there are serious problems in terms of over-exploitation of Southern Bluefin Tuna, but notes the concern of scientists and the principles pertaining to UNCLOS.

*The Commission recommends the continuation of the present policy of recovering the full cost of management from licensed foreign fishing boats.*

In as much as the access fees paid by foreign interests are freely negotiated, these fees can be viewed as mutually beneficial to the trading parties.

*The Commission recommends that foreign fishermen continue to pay access fees.*

The Commission draws attention to the desirability of including fisheries within the Australia New Zealand Closer Economic Relations Trade Agreement.

During the Inquiry the Commission was made aware of other issues which have some bearing on the cost effectiveness of fisheries management. Once it is recognised that there are interdependencies between Commonwealth and State management of fisheries, consideration needs to be given to arrangements at State level which can impede overall efficiency such as statutory marketing arrangements and impediments to restructuring.

Finally, the Commission draws attention to the current undesirable situation whereby State fishing industry councils, funded largely by State fishermen, undertake substantial industry consultative work on behalf of Commonwealth fishermen who pay relatively little to support it.

# 1 THE NATURE OF FISHERIES MANAGEMENT

While people have been fishing for food and a livelihood from time immemorial, fisheries management is a relatively recent phenomenon. It has evolved as a response to the problems of overfishing and inefficient resource allocation in fisheries, and the social problems that go with them. Management measures are, however, not without costs in terms of the resources employed by both management agencies and users of the fishing ground.

This inquiry is about how the Commonwealth should charge for the management of fisheries under its control. This chapter examines the rationale for and scope of fisheries management and the roles of the public and private sectors in providing various management services.

## 1.1 The development of fisheries management in Australia

Experience around the world has shown that unmanaged fisheries do not result in the optimal utilisation of fish stocks and the capital and human resources used in fishing. Unmanaged fisheries are what are called 'open access' fisheries; that is, anyone with the motivation and the means to engage in fishing can do so. The result is the 'problem of the commons'. Each fisherman will have the incentive to catch as much as he or she can before someone else does. This leads to over-capitalisation (too many boats), too much expenditure on fuel and other inputs, too many fishermen and crews. That is, there is too much effort applied to harvesting the available fish resources.

Unmanaged fisheries thus tend to be wasteful of economic resources which in normal circumstances could be profitably employed in other productive activities. Ultimately, the result can be depletion of the fish stock and collapse of the fishery. Furthermore, no-one has the full incentive to undertake activities which will help to build up stocks. While these outcomes are more commonly experienced in commercial fisheries, they can also occur in recreational fisheries.

It was only as recently as 1954 (Gordon 1954), that attention was clearly focused on the problems of open access. This is not to say that before this there were no fishermen who directly experienced the poor results of open access, and that evidence of declining catches existed. To the extent that fisheries management was practised in this earlier period, it was focused on biological controls, to protect stocks from collapse.

Until relatively recently, depletion of fish stocks was not a major problem in Australian fisheries. This was primarily because the commercial fishing industry was basically a 'cottage-type' industry, based on fishing ports close to domestic markets for fresh fish and using simple technology. The Australian population was relatively small for such a large country and even though mainly concentrated in coastal cities and towns, seafood consumption was a comparatively small proportion of food consumption. Foreign markets for Australian fish products were, with few exceptions, not developed. There was poor knowledge of the availability of stocks (such as prawns and rock lobsters) which were to become the basis of a major export industry. While whalers had come from the Northern hemisphere to Australian waters throughout this century, Australian fisheries generally did not attract major distant water foreign fleets.

This was to gradually change with the increased population growth after the Second World War, the development of new technology, an increasing demand for fish (partly a consequence of migration from countries where seafood consumption is popular) and government policies relating to defence and strategic concerns. Nevertheless, the development of existing or new fisheries was constrained (and remains constrained) by environmental limits. The waters around Australia do not teem with fish. Australia's arid climate, few rivers, narrow continental shelf and oceanographic characteristics provide limited nutrients and habitats for fish.

The combination of a relatively unproductive marine ecosystem and an expansion of fishing effort led to demands from the fishing industry for a different type of management response. There were calls for 'assistance', for protection from the pressures on profits from open access. This response was not by any means universal. Some fishermen were earning good profits (even in fisheries subject to too much effort) and the culture of fishing was such that fierce independence prevailed. Government involvement was not welcomed, except in situations where poor seasons (in terms of catches or prices) resulted.

The response by management agencies was mixed, depending largely on the philosophy of individual senior managers, the seriousness of the problem, and the attitudes and political pressure of fishermen. The industry was not organised and was not in a position to put a consensus view. Jurisdictional constraints (the division of powers between the States and the Commonwealth) complicated management, as did the often conflicting goals of government. In this context the promotion of regional development, defence considerations, and assistance to the ship-building industry had effects on fisheries management policies.

By the time it became apparent that fisheries management had to address the problems which resulted from open access there was, in a number of fisheries, already too much effort for the average fisherman to earn a normal return from the risky business of fishing. Fishermen had been given access rights (licences to fish) and on political and equity grounds there was no easy solution to reducing effort.

The fundamental concepts underlying Scott Gordon's analysis of the problem of the commons were recognised by many charged with fisheries management in Australia, but not by all. Australia was to gain international recognition as one of the few countries to recognise that fisheries management was not just a biological issue but also an economic one. Nevertheless, with a few exceptions, recognition of the interaction between biology and economics did not translate into changed management regimes and techniques. Even today there are some fishermen who strenuously object to government involvement for the purpose of what is called bio-economic management.

The nature of fisheries management has changed in recent times. By the beginning of the 1980s there was general, but not universal, acceptance of the desirability of addressing the common property problem and, hence, the need to apply management techniques which addressed over-capitalisation and the potential for stock collapses. There was recognition that the jurisdictional separation of State/Territory and Commonwealth powers seriously complicated management. This was addressed by the Off-shore Constitutional Settlement (OCS), although there are still unresolved problems.

Added to the impetus to the development of a new management approach was the formulation of the United Nations Convention on the Law of the Sea (UNCLOS) and Australia's declaration of the Australian Fishing Zone (AFZ) which gave the Commonwealth responsibility for determining the 'optimum utilisation of living marine resources' within the zone. This plus the technological development of distant water foreign fishing fleets (particularly in the tuna fishery) and, to a lesser extent, the interest in Australian waters by Asian fishermen put pressure on Australia to explore and develop off-shore fisheries. UNCLOS puts an obligation on the nation to permit foreign fishing if the local industry cannot utilise its resource to its optimum.

Fisheries management should be viewed in an historical context. Most of the major fisheries which the Commonwealth has been given responsibility to manage, as well as those still subject to OCS resolution, have been affected by management decisions made in the past. What is important is to learn from past mistakes so that better management will occur in future.

Fisheries management in the 1990s faces two major challenges. One is to rectify the historical problems, and this involves the restructuring of the major Commonwealth fisheries. The second is to put fisheries management into the much broader framework of modern resource management.

## 1.2 The scope of fisheries management

Fisheries management now encompasses a variety of activities which have the objective of attaining 'optimum' use of the marine environment, the fish stocks in it and the man-made resources applied to the catching and ultimate 'use' of fish.

Views differ as to what factors should be considered in formulating a set of objectives to achieve 'optimum' use of marine resources, but there is little disagreement with the propositions that the management regime should provide for long term (or indefinite) sustainability of yields, and allocation of the fishery resources among competing uses in the way which is most valuable to the community. For any particular use, be it commercial, recreational or traditional fishing, or conservation, optimum use also implies an economically efficient allocation of resources such as labour and capital (effort) in the fishery.

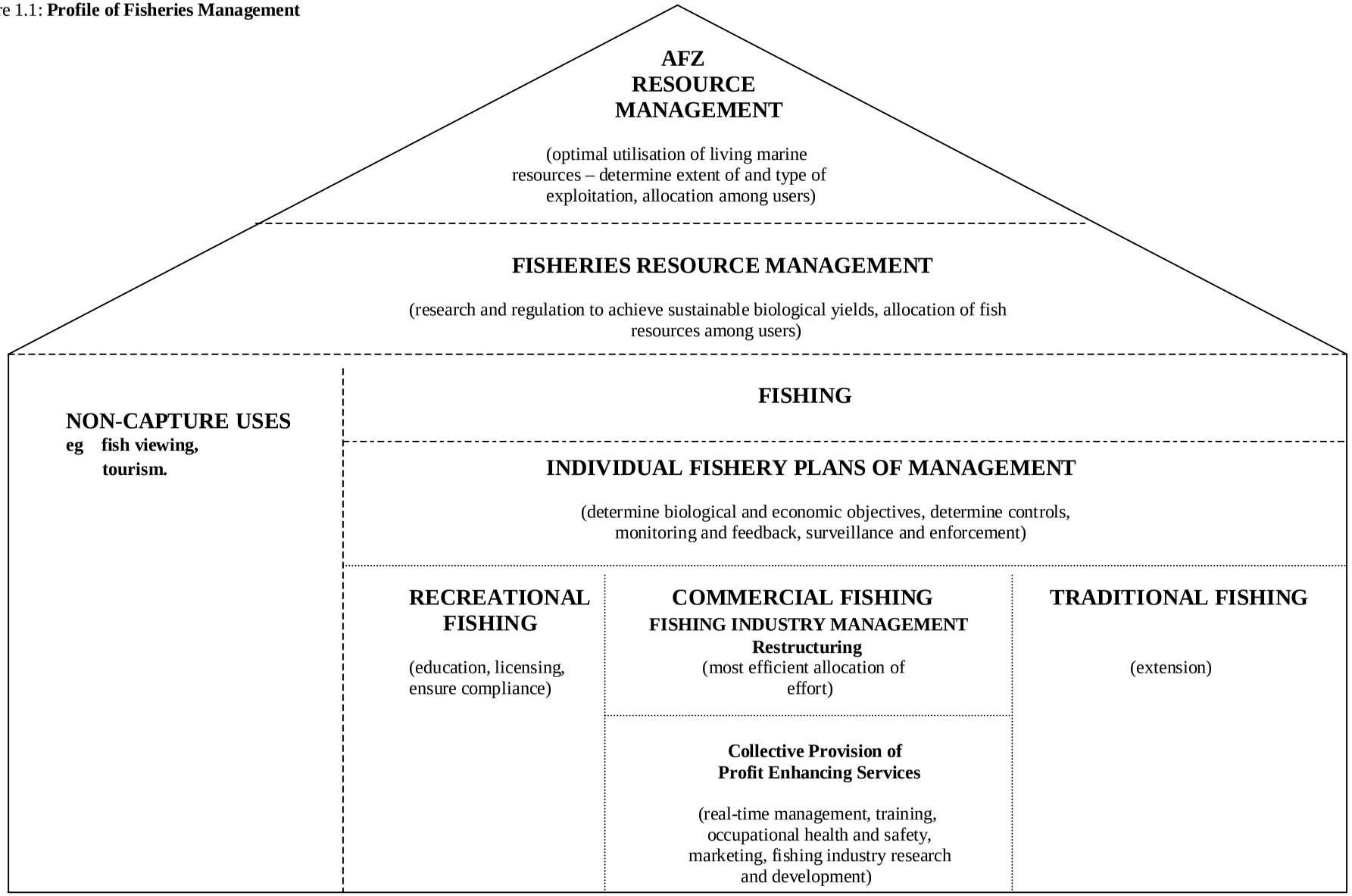
What is often ignored is that this notion of optimum use of fisheries resources implies an optimal management framework. The right amount of inputs such as research, regulation, surveillance and so forth, need to be combined to maximise the net benefits to the community. To do this the costs of alternative management regimes must be weighed against the benefits which can be derived. A regime which requires a lot of costly information to produce estimates of an optimum yield is not an optimum management method if less costly but more approximate methods can deliver higher net benefits.

Fisheries management thus seeks to achieve a number of related but conceptually distinct objectives to ensure that, over time, the use of fisheries contributes to human welfare to the maximum extent possible. This gives rise to a number of related but conceptually distinct types of management. This can be seen schematically in Figure 1.1. The over-arching element is the management of the natural resource itself, with the management of particular uses such as commercial, recreational and traditional fishing, fish viewing and marine conservation all impacting on each other to some degree.

In essence, resource management is about the 'what' and 'who' questions - determining the extent of exploitation of a fishery over time and which groups should be allowed to fish. The people of Australia generally (now and in the future) benefit from maintaining the marine ecosystem, the resources in it and from its optimal allocation among uses.

The management of particular activities involves the 'how' questions. For example, fishing industry management is about ensuring that the commercial fishing industry works efficiently to achieve the greatest benefit at the least cost to the community. While other users will consider different sets of benefits and costs, their management has the same ultimate objective of maximising the welfare of the community. The distinction among the various types of management is clear in terms of objectives; it is not necessarily so precise in terms of the measures available to implement management in practice.

Figure 1.1: **Profile of Fisheries Management**



## 1.3 Resource management

The fragile nature of many Australian fisheries and the pressures leading to over-exploitation mean that Australian society is faced with very hard choices about the rate of exploitation of fisheries. Society may wish to ensure that fisheries are exploited in keeping with the principles of ecological sustainability, but the price in the short term, in a number of Commonwealth fisheries, will be substantial restrictions in catches and significant reductions in the size of the industries dependent on fishing, both commercial and recreational. On the other hand, in the long term the application of this principle should result in increased catches, greater profits for the commercial sector and industries associated with it and recreational fishing. Even when a rate of exploitation has been determined, conflicts arise among commercial and recreational fishermen. These difficulties are magnified by the jurisdictional divisions among the Commonwealth and the States.

### Determining the level of exploitation

Resource management of the AFZ requires a thorough understanding of how the ecological systems function and how various users (including commercial and recreational fishing) affect the functioning of the systems. Long term sustainability of these systems, including long term utilisation of fish resources, is an objective of resource management.

The issue of the long term sustainability of yields is a complex matter in that for many fish stocks there is not necessarily one level of catch which can be taken but a number which can be sustained through time - subject to natural fluctuations. One of those levels of catch will be the maximum sustainable yield. Another will be a sustainable yield which maximises economic returns. The latter is normally presented as being at a lower level of yield than the former. Whether or not this is the case in practice is determined by such factors as the biological characteristics of the fishery and the time horizons of those involved. A more detailed analysis of these issues is presented in Appendix J.

At present, and presumably for some time into the future, the major cost of resource management is research. In some fisheries the ecological and biological functioning of the systems are relatively well understood as a consequence of past research. In other fisheries the need for a better understanding is critical to management.

**Allocation of marine resources among uses**

The other objective of resource management is the allocation of the resource to the most highly valued use, be it commercial or recreational fishing, preservation of species such as whales, tourism, etc. Willingness to pay for such uses can be an indication of society's values, but willingness to pay requires an institutional framework which, in this case, is based on a limited and incomplete system of access rights and the ability to trade those rights.

The issues involved in allocating marine resources are not unique to fisheries - they are common to the management of other environmental resources such as forests. Typically, choices must be made about taking less now so that more is available in the future, between targeting particular species and disturbing natural ecosystems, and about who should do the catching.

In some fisheries, such as for whales, the conservation objective has become all important. In others, such as those within the Great Barrier Reef Marine Park and other marine conservation areas, institutional frameworks have been established which aim to enable commercial and recreational fishing to occur in ecologically sensitive ways. It seems likely that additional areas of the Australian marine environment will come under this type of management regime, following the resolutions of the 17th General Assembly of the International Union for the Conservation of Nature (IUCN) in February, 1988.

In many other fisheries these issues are only beginning to be addressed. Examples are protection of marine reptiles in tropical trawl fisheries such as the Northern Prawn fishery, or the protection of benthic communities from damage by fishing gear.

Within the catching sector, more than commercial fishing is involved. Management of Australia's fishery resources must take into account the rights and social values of the indigenous people, Aboriginals and Torres Strait Islanders. Traditional fishing communities, such as those of the Torres Strait, depend on fishing for the major part of their food supply. Fishing is also virtually the major source of paid employment in such communities (see Appendix G for more details).

Another important development has been the increasing interest in recreational fishing. While this has been an important leisure pursuit, or means of supplementing diets, for Australians throughout the nation's history, increasing population, per capita income, mobility and leisure time have led to greater pressure on fish species readily available to recreational fishermen. There can be, and in some cases there already is, conflict between the interests of recreational and commercial fishermen. Some areas have been closed to commercial fishing either permanently or at certain times for the benefit of recreational fishing. Waters adjacent to tourist resorts have sometimes been closed to commercial fishing to improve the ambience for tourists.

Coastal development (the expansion of urban population in cities, the development of coastal tourism areas, and pollution from industrial developments and agriculture) has led to either destruction or adverse impacts on mangrove systems and the littoral ecosystem. For most, if not all, exploited fish stocks these ecosystems and the associated benthic communities play a crucial role in fishery productivity. While the precise relationships are still not adequately understood, the fishing industry has come to be increasingly concerned with either real or perceived impacts on its profitability resulting from coastal development. These effects too must be considered in fisheries resource management.

Other less direct objectives of governments also influence who uses marine resources. While the national obligations flowing from the UNCLOS are relatively straightforward, access of foreigners to fisheries can become objects of international trade relations and diplomacy.

**Limited knowledge**

Just knowing what fisheries resources are there and the effects of exploitation on marine ecosystems is a major problem for resource management. While a farmer can see to count the number of cattle in the paddock and touch them to assess their condition, it is not easy to tell either how many fish there are, their condition, or where they are.

To achieve sustainability the most significant management cost involved is that of scientific research to establish the ecological/biological relationships which are a prerequisite for setting the total allowable catch (TAC). This will differ from fishery to fishery. The future amount of expenditure needed for this task will be influenced by the amount and success of past research. For example, the Northern Prawn fishery has been researched for a substantial period and much is known about the important ecological and biological relationships in the fishery. It will also vary with the state of the fishery. Research into new or depleted fisheries can be much more difficult than research into fisheries in equilibrium.

Research to better understand ecological and biological characteristics can provide information which has applicability beyond that of managing for sustainable catches. This emphasises the public goods nature of some of this research.

Inevitably there is a high degree of uncertainty about the results of research and policies flowing from them can be contentious. In many fisheries there is little information about the effects of fishing on the resource. Adverse effects are usually apparent only after the impacts are well advanced. By the time allowance is made for natural variability in recruitment and stocks, years will probably have elapsed before remedial action is proposed, let alone put into effect. Even then, what is apparent to a population dynamics expert may not be apparent to the fisherman on the water who has pressing financial reasons to want to believe that all is well. The performance of research as a part of fisheries management is reviewed in Chapter 5.

**Differing time horizons**

Choosing an optimal catching regime means making choices between now and later, and often between current and future generations of fishermen and fish consumers. Targeting particular fish will also affect predation patterns and can alter the species composition within an ecosystem, thereby changing the availability of certain species in the future.

Changing the weight given to future generations can affect the rate at which species are fished, as well as the techniques used. In the short run at least, reducing catches now for future benefit can be expected to adversely affect both current fishermen and consumers. The costs will be borne by

those in the industry now, while the benefits will be received by future generations. Such effects are not so likely with short lived or highly fecund species. They are particularly important for fish which school, are long lived and slow to reproduce.

Differing time horizons are at the heart of the debate over sustainability. Put simply, sustainability requires the maintenance of ecological relationships in a fishing ground. For commercial, or commercial and recreational fishing, this means management to sustain catches indefinitely. The concept can, with greater difficulty, be applied to multiuse marine parks such as the Great Barrier Reef Marine Park. This concept has come to be referred to as 'sustainable development' (World Commission on Environment and Development) or 'ecologically sustainable development'. The Ecologically Sustainable Development Fisheries Working Group has recently released its report on this issue.

The concept of sustainability focuses on equity between generations (or equity through time). If sustainable catches can be guaranteed by management action, the beneficiaries presumably include this generation (as a consequence of its support for the concept) and future generations (inasmuch as they have the same choice to use the fishing ground that the present one has). If all generations follow the same principle, sustainable catches are perpetual.

To what extent do present fishermen benefit from sustainable catches? In theory, the answer to the question to what extent fishermen would be willing to pay for sustainable catches is assisted by knowing the difference between the time preference (discount rate) of fishermen and that of society. If society has a zero discount rate its objective will be perpetual sustainability. As the fishing industry has to operate as a business in competitive markets with positive discount rates, it is likely that society and industry will evaluate catches through time in different ways. How significant these different discount rates will be depends on the nature of the fishery. In a fishery utilising short lived species such as prawns, for example, the time for recovery of depleted stocks is so short that there may be little practical difference. In fisheries utilising longer-lived species the differences can be very great indeed. One of the functions of resource management is to implement management measures to ensure that if these differences in time horizons are so great as to threaten long term sustainability of the fishery, society's values take precedence.

In a fishery which has been managed for biological sustainability, the introduction of management to achieve economic efficiency may actually reduce catches. If the fishing industry had a zero discount rate, the level of catch in any period would be below maximum sustainable yield (see Appendix J for a detailed discussion of this concept). Even with a positive but low discount rate, catches may still be low enough so as not to threaten long term sustainability. Whether or not catches are sustained at or below maximum sustainable yield will depend on the level of the discount rate, the growth rate of the stock, and the degree of schooling of the fish.

Today's fishermen have incentives to favour the present over the future. As a general rule, individuals have shorter time preference rates (equal to higher discount rates) than society has. A very high discounting of the future increases the likelihood that any fishing ground would be 'mined'. However, with long lived schooling species, 'mining' could still be the result even with relatively low discount rates. This could be rational economic behaviour for fishermen if they could invest the profits from 'mining' in businesses yielding a higher profit than that potentially obtainable from sustainable fishing.

With regard to this, much depends on the existence of more profitable investments and the often observed life-style benefits from commercial fishing. An important constraint for many commercial fishermen is the considerable investment in fishing rights and boats in fisheries which are fully developed. A market for fishing rights and boats which would allow them to recoup the value of their investment will only exist if potential new entrants believe they will catch enough fish to make their investment worthwhile. New entrants will require some evidence or at least have to believe that they are entering a fishery which will produce sustainable catches for them.

Fishermen's incentives to harvest the catch in a sustainable manner will depend upon their security of tenure over access rights and the capacity of markets for property rights to reflect adequately the increased value of the fishery, resultant from their investing in the stock. Failure to adequately value sustainable future catches can lead to increased fishing pressure to-day. This can happen when the fishery has become so depleted that the probability of recovery within a reasonable time scale is low. It can also occur when there is great uncertainty. This can occur because of lack of knowledge about the fish population biology, or because of the uncertain effects of factors such as pollution or habitat destruction on an ecosystem.

Without adequate management controls, the 'if I don't someone else will' syndrome will lead the fishermen as a group to do what they would not do if they were sole owners of the fishery. Furthermore, immediate commercial pressures can lead to conflicts between what industry would like to do for the long term future of the fishery and what it feels forced to do to stave off bankruptcy. Chapter 5 and Appendix G provide a number of examples which suggest Australian fishermen have been willing to fish beyond long term sustainable catches. Fishermen in declining fisheries tend to oppose lowering TACs when scientists find that biological over-fishing is occurring, particularly if they cannot move to another fishery.

For all of these reasons, government involvement is necessary if the objectives of resource management are to be achieved. Biological controls which, for example, prohibit damage to breeding and nursery grounds and the ecological system in general are usually required. Permanent area closures, seasonal closures and gear limitations are, or can be, necessary controls.

## 1.4 Fishing industry management

For any given level of catch, optimal use of the fishery involves making the most efficient use of the resources in it and that means minimising costs of production. (Appendix J provides a more detailed discussion of the issues involved.) This is a problem common to all businesses. However, many of the activities of government fisheries management agencies are directed to aspects of detailed management of fishing industries themselves. In part this is because some measures aimed at ensuring optimal catch policies involve regulating the way fishing is conducted. But it also stems from the desire to overcome the problem of excessive effort which results from the common property problem.

### The optimal level of effort

Determining the optimal level of fishing effort requires a sound scientific basis for predicting yields once the new predator (fishermen) is introduced. What is involved is an understanding of stock

dynamics in an exploited fishery and, on this understanding, the ability to set the TAC. This is a complex matter as yields can be sustained at various levels of the fish population. Nevertheless, it is generally agreed that the ideal biological position is the maximum sustainable yield (MSY) with effort regulated to achieve this. Due to natural variability the MSY should be viewed as a range rather than a single point. Assuming it is possible to determine the approximate MSY, the fisheries manager has one crucial piece of information. This establishes a biological constraint on the amount of effort which should be devoted to the fishery.

If the biological understanding of a particular fishery is so poor that an approximation (with a reasonable degree of accuracy) of the MSY is not possible (that is, it is not possible to set a TAC) uncertainty dominates the decision to permit specific levels of fishing effort. Various 'rules' have been formulated for decision-making under uncertainty, but all involve subjective evaluations of the probabilities of certain events occurring (which could range from collapse of the stock to severe under-fishing). The recent experience in Australia is that managers have not been able to set a sustainable TAC for a number of fisheries.

Given that a sustainable TAC can be established, the objective of management is to redress the problem of open access. This is achieved by restricting the level of effort in the fishery. In its simplest form this means reducing and holding effort to the MEY level. In the simple model generally used to illustrate the bio-economic relationships in a commercial fishery two assumptions are made which all have a bearing on whether or not the MEY level of effort is less than, equal to, or greater than the MSY level. They are that each unit of effort (for example, a boat) enters the fishery at constant cost and that the discount rate is zero. In this model the MEY level of effort is lower than the MSY level and consequently sustainability is not threatened.

At the MEY level of effort the difference between the total return (value of product caught) and the aggregate cost to fishermen (being the costs of capital in the form of boats, and variable costs such as labour, fuel, management, etc) is the greatest. This contrasts to the open access situation where the aggregate return and aggregate cost are, in theory, just equal. It must be noted that in the open access situation, on average, normal returns (including normal profits) would be earned by all those

supplying factors of production. One factor of production, the marine environment, would not earn a return. This can be contrasted to the fact that agricultural land (which is somewhat analogous to a fishing ground) earns a return which in economic terminology is called 'rent'.

The fact that a lesser level of effort (number of boats) than the open access level allows for an increase in revenue per unit of effort means that the fishing ground - as a productive resource in its own right - commences to earn a return which is commonly called 'resource rent'. This is to distinguish it from other types of 'economic rent' which some fishermen ('highliners') might be earning under open access or any other level of effort. Reducing effort below the open access position requires management inputs, and the ultimate benefits are a result of management actions, hence they are often termed 'management rents'.

*Ways to address the open access problem*

It is necessary to clarify how the open access problem for a commercial fishery can be resolved within the general framework of resource management. The resource management framework would have to establish appropriate biological controls such as seasonal and area closures, gear restrictions and the total allowable catch. How the open access problem is resolved has a direct bearing on charging for management.

There are three alternative measures which can be used: royalties (a tax on landings), input controls and output controls (such as individual transferable quotas). Within each fishery there may be factors which make some measures more efficient than others. Designing an appropriate response to the open access problem is a matter of fitting available instruments to particular targets. In theory there is no reason why a mix of instruments cannot be used to achieve appropriate policy objectives.

One measure is a royalty which in its most effective form would be a charge on landings to bring private costs to individuals into agreement with social costs to the fishery as a whole. Royalties price the fish, so the fish will be treated like other inputs in fishermen's production decisions.

If the appropriate royalty could be set, normal market-based behaviour of fishermen will produce an efficient industry. Fishermen would choose the fishing method and where and when they fish.

What the royalty would do is reflect the market conditions that prevail for the use of other natural resources for which complete property rights exist. In other words, a royalty is one regulatory mechanism which could be used for fishing industry management.

Nevertheless, there is a significant difference between the use of royalties in preventing, or overcoming, the open access problem in the development of a new fishery, and the use of royalties to correct a situation of severe excess capacity - and probable depletion of the resource - which has already occurred. In the latter case there will be some level of royalties which will reduce effort to the efficient level, but this will need to be so high that all fishermen incur losses. Crutchfield (1982, p. 13) has put this succinctly:

> ... economic theory and common sense tell us that prices must be driven below out-of-pocket operating costs before anybody will be induced to leave.

The correct level of royalties, given the vagaries of nature (catches) and markets for fish, is likely to change from year to year. This would require a great deal of information which a fisheries management authority is unlikely to have. This makes it difficult to use royalties as a short term, flexible means of achieving restructuring to produce an efficient fishery.

Another measure is to limit the amounts of inputs directly. This requires licensing boats and/or gear. It must prevent 'upgrading' of boats/gear. Limited entry does nothing other than stop, or retard, effort increasing (and catch per unit effort falling). Additional steps are required if the level of effort in fishery is to be reduced from, say, the open access level. One such is a buy-back scheme whereby units of effort such as boats or licences are bought back and retired by those remaining in the fishery. The success of such a scheme, and also the degree of efficiency of any regulatory regime which uses input controls, is dependent on the ease of substitution between restricted and unrestricted inputs. The easier it is to substitute other inputs for the restricted input, the greater the buy-back needed to reduce effort by the required amount.

If limited entry entitlements can be transferred, and if fishermen have sufficient information and the financial incentives to undertake a voluntary buy-back program, much of what else needs to be done to achieve an efficient commercial fishery can be left with the fishermen. However,

> [buy-back] will become impossibly expensive unless some of the rising income of the remaining participants is siphoned off by a landing tax, which can be used not only to cover management costs but to fund a gear reduction buy-back programme (Crutchfield, 1982, p. 18).

Buy-back is discussed in some detail later in this Report (see Chapter 5 and Appendix J).

The third method of achieving a rational economic performance in a commercial fishery is the use of quotas. A global quota has to be set and proportioned into shares, which can be distributed to existing fishermen (according to certain criteria) or auctioned. As the total catch is set there is nothing left for a fisheries agency to do other than ensure the total and individual quotas are not exceeded, and necessary biological controls on areas or for seasons are adhered to. Individual transferable quotas (ITQs) provide the incentive for fishermen to improve efficiency of their operations. Individual quotas will be transferred in the marketplace. Prices will adjust so that the necessary reduction of effort will occur without any action by a fisheries agency. However, as Crutchfield (1982, p. 19) warned:

> It is also fairly obvious that if the ITQs scheme is to have any effect in reducing excess capacity in a fishery it will do so with ruthless effectiveness - that is, the price of the shares will be bid up rapidly to the point where substantial numbers of marginal fishermen will be forced out of the fishery rather abruptly. While this has obvious advantages from the standpoint of efficiency alone, it may raise really serious social and equity problems unless the process can somehow be slowed down. There might also be enforcement problems. If the fishery normally funnels through a few centralized ports, monitoring should not be overly difficult. But since both buyer and seller would have the incentive and opportunity to understate the individual fisherman's catch, the possibility of widespread violation might be an important barrier if fish are marketed through many small landing ports.
>
> Finally, in common with all other rationalisation schemes, including taxation and limited entry, the individual quota system would work efficiently only if it were applied to all fisheries to which the gear can be shifted. Otherwise, successful reduction of excess capacity in one operation simply passes the problem over to another.

Royalties, ITQs and transferable licences attached to inputs all have the effect of putting a price on the right to access the fishing ground (or fish). This pricing effect, as in normal markets, goes a long way in achieving efficiency - that is, to improving the profits of fishermen, allocating resources to their most valuable use, and providing what the consumer wants at least cost.

Related issues are the duration of the access rights, the means of their allocation and the costs of implementing and complying with them. With the enactment of the Fisheries Management Bill the Government has recognised existing fishing rights to Commonwealth fisheries (called 'Statutory Fishing Rights') and the duration of these rights is tied to the Plan of Management for the fishery. That is, if a Plan of Management is revoked the fishing right will cease to exist.

The method for allocating rights (and the duration of rights) influences their value. 'New Directions' (p. 28) in its discussion of the auctioning of access rights states:

> Providing information is freely available and the auctioning process is competitive, the winning bid at an auction will reflect the present value of the future stream of profits that an asset will generate. The auctioning process is therefore an efficient means of allocating access rights to fisheries. If potential bidders have incomplete information but suspect that the likely returns will be high, they will have an incentive to seek better information ... In most developed fisheries a well established set of access rights already exists and fishermen have invested in boats and equipment in the expectation that these rights are ongoing. In addition, in existing fisheries, resource rents have already been capitalised into the value of access rights, with many fishermen having purchased these rights.

Experience has shown that we have not had adequate information to set accurate TACs which would allow for informed bidding for ITQs or other forms of access rights. The other issue is that if expected resource rents have been capitalised, the price of access has been paid once and for all by new entrants and taken as a windfall gain by the original fishermen who were given the rights.

Given the depleted state of so many Commonwealth fisheries, another consideration is the risk that the fishery will be substantially reduced in size or even closed. The resource management authority can affect the future value of such rights by setting new TACs.

The final variable to be considered is the cost of implementation and enforcement. Australia's limited experience with these measures does not provide a sound empirical base for such judgments. However, material before this inquiry indicates that the costs are likely to be significant and should not be assumed away when decisions are being made about which system to use. It is clear that there is no best answer for all situations. The appropriate mix of policy instruments will vary from fishery to fishery.

**Collective provision of fishing industry management**

With the introduction of cost recovery, fishermen have taken a far greater interest in fisheries management. The Commission frequently heard the lament 'We are paying for management; we want management, but we are not getting management which results in benefits.'

As the Commission has examined such statements and the effects of fisheries management measures on the fishing industries, it has become apparent that there is another problem in achieving efficient use of resources in fisheries - managing the fishing industry itself.

Fishing industry management is the sort of management that business in any normal industry would undertake. If a fishery were controlled by a sole-owner, it would undertake management activities to produce the firm's product in the most efficient way, and to market products to suit customers' needs and maximise returns. Given that there are no sole-owners of wild capture fisheries, the only way industry-specific management can be undertaken, other than by government, is through collective action by those operating in a fishery. It is feasible, but nevertheless difficult, for a group of fishermen to act on certain matters in a manner similar to that of a sole-owner. The key is in the structure of fishing industries, which are generally characterised by large numbers of relatively small firms, many being owner-operators. Few have any significant market power. This makes it difficult for them to band together to do things collectively to reduce costs or obtain higher prices by achieving better quality products or reducing the incidence of gluts and shortages in the fresh fish markets. The primary beneficiary of such measures is industry itself; it could be expected to undertake them if the problems of collective action could be overcome.

Problems of (private) collective goods provision are common throughout the economy in industries with large numbers of relatively small firms, particularly when they are spread over a large area. In such industries, communications tend to be difficult and costly, individual firms are highly competitive, and they are often not aware of the impact their individual actions have on the group

as a whole. In such circumstances, it is very difficult for them to clearly identify means by which they could improve their positions through collective action. Even when they do, it is difficult to ensure that everyone plays by the collective rules, or contributes to the provision of services from which they all benefit. This is the 'free-rider' problem.

If fishermen were to band together to provide such management services within their fishery, the efficiency of the industry would improve. They would be unlikely to have any significant market power which would be a concern on anti-competitive grounds. This is because there would still be intense competition between fisheries, and between domestic production and imports; and, those fish which are exported form an insignificant portion of the world market.

Enabling collective goods and services to be provided has long been a function of government. In many Australian fisheries, efforts have been made through government agencies to overcome some of these problems with varying degrees of success. Some fisheries agencies provide, or help the industries themselves to provide, a range of collective goods and services. This will be discussed in later chapters of this Report. The Spencer Gulf prawn fishery has gone further than most in providing research and marketing advice and in 'real-time management'. The Commonwealth's efforts in this area are fairly limited.

## 1.5 Interrelations between resource management and fishing industry management

The distinction between resource management and fishing industry management rests on the objectives of the management activity rather than on the instruments used. These distinctions are clear where output controls are used. In this case, the 'what' question, the extent of exploitation, is addressed by setting a TAC and the 'who' question by the allocation of ITQs. How fishing is undertaken should be left to the fishermen. However, in input controlled fisheries the 'what', 'who' and 'how' questions are interrelated. Who is (or at least 'how many are') permitted to fish is

determined by a management enforced limit on boats and/or gear, that is, there is limited entry. The desired level of exploitation (the 'what' question) is also essentially determined by the limit on boats and/or gear. Where there is a significant difference between this approach and ITQ management, is that the input controls determine to a significant extent *how* fishing is undertaken.

In an ITQ managed fishery the incentives exist for industry to restructure itself by fishermen buying and selling quota. The less efficient fishermen are those most likely to sell and the level of effort in fishing will always tend to approach the economic efficient level (MEY). This process is not automatic in an input controlled fishery. If there is too much effort in it (too many boats to achieve MEY), there will need to be an effort reduction program, a voluntary or enforced buy-back. If, as is usually the case, the input controls impede the use of the most efficient mix of inputs, there is a loss in social welfare. If, notwithstanding the controls, effort increases beyond the MEY level, a new program of effort reduction will be required.

It is feasible, as argued previously, for all participants in a specific fishery to act collectively to formulate a system of input controls and voluntary buy-back (if necessary) with the aim of achieving the maximum net return from the fishery (MEY), within a constraint of sustainable yields set by the managers. This would be collective action for private gain, and hence is most appropriately viewed as an element of industry management.

# 2 PRINCIPLES OF CHARGING FOR FISHERIES MANAGEMENT

The previous chapter has indicated that fisheries management involves a complex set of interrelated management issues. Distinguishing the issues involved in management of the resource itself from the management of particular users, such as commercial fishing, is fundamental to understanding the benefits and costs of fisheries management. This chapter examines the roles of the public and private sectors in providing various management services and how, in principle, charges should be applied.

## 2.1 The benefits and costs of fisheries management

The term 'benefits of management' has been confused by semantic problems. This term is used in many different ways. The Commission has seen the term used to describe at least eight different things:

- success in achieving management objectives such as sustainable catches or reductions of effort;
- efficiency gains to the economy or industry;
- expansion of an activity, industry or region;
- assistance to an industry;
- value added in any activity;
- generation of economic rent by `highliners' regardless of the profitability of the fishery as a whole;
- privileged access to public assets such as fisheries; and
- the distribution of rent or privileges among individuals.

The Commission considers the principal benefit of fisheries management to be achievement of optimal utilisation of Australia's living marine resources. This involves resolving the resource management questions described in the previous chapter, and improved efficiency in use of fishery resources in both the short and long term. It requires efficient and effective management of the resource, the fishing industry, recreational fishing, traditional fishing and other uses of the marine environment, from tourism to conservation and environmental protection.

The practical problems of measurement of such achievements are very great. In the time available for this inquiry, it has not been possible to undertake formal, quantitative benefit-cost analyses of Commonwealth fisheries management. However, some qualitative analysis has been possible and is reported in Chapter 4.

Generally speaking, the welfare of the *Australian* community should be the benchmark for analysis of Commonwealth policy. Some aspects of fisheries management affect the welfare of other nations or of the world as a whole. Except in specific situations, measures which make other countries better off at Australia's expense are not considered benefits for the purposes of this Report.

**The distribution of benefits: the BAE approach**

Making the distinction between resource management and fishing industry management allows insights in the analysis of the benefits and costs of fishery management which go beyond the work on the distribution of benefits of fisheries management by the then Bureau of Agricultural Economics. The BAE's study (BAE 1986) provided the basis for the Commonwealth's cost recovery policy.

Commissioned to report on the distribution of benefits of fisheries management, the BAE used the standard, simple economic framework. This involved analysis of the effects of changing a fishery from an open access (unmanaged) situation to one where effort is reduced so that management rent is maximised. The same approach could be applied to analysis of the effects of moving from a situation where a fishery was managed sub-optimally (that is, with excess capacity) to a situation of optimal management.

By extending this framework it would have been possible to deal with the more general, and more difficult, issue of determining the optimal allocation of marine resources among competing uses. While the BAE dealt with this issue to a limited extent, the focus on the benefits to be gained from restructuring commercial fishing limited the applicability of the analysis. (Appendix I outlines a framework for resource sharing). The focus of the BAE's analysis was on those aspects of

management that result in identifiable private benefits to users of the resource and which are reflected in the price system. Those aspects of resource management that may benefit the community generally were not drawn out in the analysis.

The BAE found that, in theory, the result of effort reduction was that catch and revenue per unit effort increased. This is unexceptional and the expected result (although in fisheries where catch could not increase only revenue per unit effort increased). Put simply, with less boats, fishermen, fuel, etc used in the fishery to catch the same quantity and value of fish, those remaining in the fishery were better off. The next step in the BAE analysis was to determine the distribution of the increased returns to the fishery among all potential beneficiaries: the catching sector, the processing sector, input suppliers, consumers. It found, on the basis of estimates of demand and supply responses (elasticities), that the catching sector obtained 90 to 100ÿper cent of the new returns. To calculate the extent of net benefits of restructuring to achieve management rents the costs to management agencies of achieving this outcome have also to be taken into account. Assuming the desired goal is achieved (that is, effort is reduced to maximise management rents), there would be on-going costs associated with research, monitoring and enforcement.

Management also can impose compliance costs on fishermen by restricting when, where and how they fish. A variety of controls, such as gear restrictions, prohibition of fishing in nursery areas, seasonal closures and size limits, are used in some fisheries. Controls of this type are usually justified as an essential component of management to achieve a dynamic MEY; that is, they provide for the possibility of larger catches in the future, or of eumetric fishing - the selection of both age of first capture and effort to obtain optimal catches. In some circumstances regulations are used to prevent the destruction of a fishery which could occur at times when it is particularly vulnerable.

Management action, such as a phased reduction of effort, does not bring immediate benefits. This the BAE recognised in its study:

> An important feature of some management schemes is that substantial benefits may accrue only a number of years after the initiation of a scheme, whereas management costs are incurred from the beginning and may, in fact, even be higher in the initial years when establishment costs are incurred. It is therefore likely that, in many fisheries, costs of management will exceed benefits during the period in which the fishery is adjusting to the

> introduction of the management regime. This time lag between the introduction of the management plan and the generation of market benefits may lead to intertemporal inequities, with later arrivals to the fishery avoiding the high early net cost. However, this consideration is not likely to be a major problem ...
>
> The investment in management through a levy is no different from a capital investment which is expected to provide a flow of services through future time periods. If investors should decide to leave an industry before their investment has come to fruition, then the sale of their investment should reflect the higher expected future profits. In the case of fisheries, the sale value of the fishery licence should reflect the expected gains from management, and the fishermen who leave the industry should derive an appropriate return on their investment in management. Provided licences are able to be traded, therefore, intertemporal inequities should not arise.

As a statement of theory this analysis is correct but there can be factors which make the real world situation different. There is considerable evidence of the value of fishing entitlements increasing when management actions are introduced, such as with the imposition of limited entry in an open access fishery. There is also evidence of the same result with the announcement that management action (which is *expected* to improve the profitability of fishermen) will occur in the future.

However, the extent to which such capitalisation of expected gains will occur will depend on the state of the fishery when management is introduced. In fisheries subject to very drastic decreases in yields and profits and, particularly if these are expected to continue for some time into the future (because the time for recovery is a number of years), the value of entitlements cannot be expected to increase with the introduction of a new management scheme. The uncertainty as to the timing of eventual recovery and the level of profitability in the distant future will mean that fishermen will heavily 'discount' the potential gains. The need to service existing debt (at the market rate of interest) will also be reflected in high discount rates, and make it extremely difficult for fishermen to accept management policies which will decrease their earnings now in the interest of increased profits in the future.

As many of the Commonwealth's major fisheries are subject to declining catches and a high degree of uncertainty as to sustainable yields, the real world situation, at present, does not reflect the situation described by the BAE. Five years ago when the BAE study was undertaken most involved in fisheries were far more optimistic than they are to-day. For example, the problems of falling catches now being experienced in Southern Shark and the South East Trawl were not obvious. Management schemes to restructure fisheries were expected to be introduced in relatively stable fisheries.

There are practical problems in applying the BAE findings to-day. With limited exceptions, the type of management decisions that would be needed to produce the BAE result have not been taken. Most management activity has been of the on-going type (administering a licensing system, monitoring and surveillance). Compared to the costs of these management activities (including research undertaken by CSIRO and other bodies) the costs incurred by the Commonwealth in restructuring fisheries are quite small. There are no empirical data to validate the BAE findings. In the intervening period there has been an increase in recreational fishing in the SET and tuna fisheries and increased attention is being given to the non-use values of the marine environment; that is, the non-market benefits are likely to have increased.

Another practical issue - and one which was recognised by BAE - is that it did not have empirical data on the costs of management. The benefits of management need to be considered net of the costs, but the costs were unkown and possibly higher than optimal, because management services were provided by government with monopolistic powers. If the management costs were higher than optimal, managers would also be beneficiaries.

A further practical issue, again recognised by the BAE, is that their general conclusion about distribution of the benefits of management does not necessarily apply to all Commonwealth fisheries. The main reason is that the demand elasticities vary between species and, consequently, in some fisheries the percentage of the benefits accruing to fishermen is likely to be lower than 90-100 per cent average overall.

Another important issue considered by the BAE was whether management benefits other users (such as recreational fishermen) as a by-product or whether additional management was required to meet their demands. The study pointed to the need to identify 'intramarginal' non-market beneficiaries of management. The concepts involved can be illustrated by considering a Plan of Management put in place solely for the purpose of improving the profitability of the commercial

fishing industry. That Plan could have positive benefits for recreational fishermen, but if their benefits do not subtract from the benefits to the commercial sector and if no additional management costs are incurred to produce the benefits to recreational fishermen, the benefits to recreational fishermen are intramarginal.

Once recreational fishing is recognised as a 'partner' of commercial fishing and resource sharing between the two is required, the issue of intramarginal benefits does not arise. In some fisheries recreational anglers are significant users of fisheries resources, often in competition with the commercial fishing industry. Furthermore, the management of recreational fishing itself entails a number of distinctive management activities from which recreational anglers benefit. In both of these cases the benefits to recreational fishermen are definitely not intramarginal.

A further consideration in applying the BAE analysis is the question of whether or not there are benefits arising from secondary activity (such as processing) stemming from the primary activity of catching fish. The BAE (1986, pp. 25-26) argued thus:

> Insofar as management may lead to a higher level of catch than would otherwise exist, these other sectors, it is argued, obtain benefits. That other commercial sectors may obtain benefits has already been demonstrated but these benefits are shown to be transfers, the level of which is determined by market forces. To aggregate the first round benefits arising from management (say, increased output of fish) with increased sales volume or employment at the processing level is simply a case of double counting the same benefit. Similarly, it is fallacious to argue that the output of downstream activities should be added to that of the primary activity, such as fishing, in determining the contribution of the primary activity to the economy. All parts of the economy are interdependent and it is just as illogical to argue that the contribution of the energy sector (fuels, oils etc.) to national output should include the output of the fishing sector merely because it is a consumer of fuel. In both these examples, benefits are simply transferred, not increased.
>
> It cannot be denied that, in the absence of a primary activity, many secondary activities would not exist. And if a fishery closed down, then resources in the secondary activity may face a period of unemployment if no substitute for the fishery product is found. However, an economy is dynamic, and resources, be they labour or capital, can be expected to move into alternative uses where returns are positive. These positive returns are the opportunity

cost of keeping these resources in the secondary activity associated with fishing. As such, the maintenance of resources in these secondary activities is a cost to society since these resources are prevented from being utilised in alternative industries. From the national point of view, therefore, any assessment of the contribution to the economy of a primary activity should not include the benefits or costs from these secondary activities.

Although this assessment is valid, multiplier effects may be significant in the short run when some resources (in particular fixed plant) cannot move readily into alternative uses. The opportunity cost of existing processing plant, for example, could be low and should be considered as 'sunk costs'. Thus, in the short run any positive flow-on effects from increased fish catches which increased employment and utilisation of plant capacity would be net benefits to society.

The BAE assumed that maximum sustainable yields would be met by achieving MEY. In this way both resource, and fishing industry, management is complementary. But, as already discussed in Chapter 1, this result will not be guaranteed if the simple model, with a zero discount rate, is not used.

More realistic models, using a positive interest rate, and alternative population growth functions, may show that resource management objectives are not necessarily met by achieving the fishing industry management objectives.

For all of these reasons, the Commission considers it appropriate to use a somewhat different approach to that used by the BAE. The approach taken in this report is to separate management into a hierarchy of functions relating to resource management, and management of particular uses such as the commercial fishing industry. The framework is based on the principle of dividing management activities into those which provide largely public goods and services and those which provide private goods and services.

**The Commission's approach**

The objectives of management can be viewed as a hierarchy. Government has the responsibility to manage the AFZ for the benefit of this and future generations. This requires, in a general sense, sustaining the ecological functions of the system - given the state of knowledge - such that maximum benefits are gained from marketed and non-marketed goods and services. It is an intertemporal allocation problem which can only be addressed by an integration of economics and ecology and taking into account changing social values.

Due to uncertainty and possible irreversibilities the ecological objective is likely to require the imposition of some overall constraint on human activities - the safe minimum standards approach as proposed by Bishop (1978) or incorporating a 'sustainability' constraint as advocated by Pearce et al (1989). Within the limits of any such constraint, market prices and market-based measures of willingness to pay for non-market services (such as species protection) can be used to allocate the resource to its highest 'use' value. This allocation of rights is a Government function. With the enactment of the new fisheries management legislation there is some overlap of these high order resource management responsibilities between AFMA, as one agency of Government, and those functions which are the responsibility of a number of other government agencies, both Commonwealth and State. This is because the formulation of Plans of Management for Commonwealth fisheries have to have regard to sustainability principles, and the two user groups, commercial and recreational fishermen, are to be considered in the allocation process.

The next order objective in the hierarchy of resource management tasks is to manage fisheries (as part of the AFZ) to maximise economic efficiency. Under the new legislation this is the responsibility of AFMA. As discussed throughout this report, economic efficiency in a fishery cannot be divorced from the biological and ecological functions of the environment and the fish in it. For an ITQ managed fishery the resource management task, setting the TAC, is divorced from the industry management issue of how to fish. For input controlled fisheries there is interdependence.

Finally, there are those things which can, and should, rightly be left to industry, or other private users of the resource. For the commercial fishing industry, fishing industry management activities aim to improve the efficiency with which resources are used in the industry. They include collective services such as fishery-specific research, marketing, product development, post-harvest handling and quality control, training, and real-time management.

Recreational fishing and non-capture use of fisheries have to be considered in terms of this hierarchy. In fisheries subject to these uses, there is the need to integrate their management at each level. Allocation of access rights and catch limits are management functions pertaining to recreational fishing.

The management of non-capture uses of fisheries, such as tourism, fish viewing and marine conservation and preservation involve a range of other measures, including limitations on boat numbers, exclusive access rights to particular areas, and controls on behaviour of vessels and tourists.

This separation (and hierarchy) of functions can be used to determine the beneficiaries of management. It is the point of commencement in identifying who should pay for what - based on the beneficiaries pays principle, or, in other words, whether or not the services provided by management are public goods or private goods. The delineation is not clear in all cases and there is a graduation in the spectrum going from public goods to private goods.

## 2.2 Categorising Public and Private Goods

A public good has two characteristics which distinguish it from the private goods. First, if a public good is provided for one person it is automatically provided for all because it is not feasible to charge individuals for use of it or to exclude any one from using it. Second, the use of a public good by one person does not diminish the amount available for others.

Defence and law are classic polar examples of public goods. Most of the goods and services provided by governments lie somewhere on the spectrum between the polar extremes of pure public and private goods. This applies to many of the fisheries management activities considered in this report.

Surveillance is a case in point, with one philosophical perspective being that it is a normal policing function of the State and, hence, like police forces, should be paid for by the community. A detailed discussion of this issue is presented below to illustrate the complexities, philosophies and practicalities involved. Research is another, but different, case. Due to the public good nature of much of research and the uncertainty that research will provide results (particularly those which are useful to the market place) most research in Australia is publicly funded. This point has been highlighted by the Chairman of the Rural Industries Research and Development Corporation who said:

> Most of the research and development effort which underpins rural industries is public sector funded, with only limited levy contributions from rural producers themselves.

## The Functions and their Public-Private Good Nature

### Classifying management functions

The hierarchy of management objectives and functions, discussed previously and shown in figure 1.1, is used here to categorise them as either public or private goods, to the extent that this is possible.

The highest order function of resource management is related to managing the whole AFZ. It consists of a number of activities:

- policy formulation by Governments, Commonwealth and State;
- on the basis of the policies, determining, in the broadest sense, the permitted uses of the AFZ;
- allocation of rights to use, including the rights of any foreign access to fisheries;
- legislating to achieve these policies;
- protecting the AFZ, by surveillance and enforcement, from foreign intrusions.

These are, by necessity, functions of Government. They are undertaken to sustain the resources of the AFZ for the benefit of the Australian people, now and in the future. Some of these benefits accrue in the form of charges for access by foreigners to the resource, protection of the marine environment, scientific understanding of the resource, and so forth.

The second order function of resource management, the management of individual fisheries, includes:

- policy formulation and research related to the fishery resource;
- on the basis of these policies, determining the level of exploitation in any fishery;
- allocating rights to use, including rights to commercial and recreational fishermen;
- formulation of Plans of Management to achieve the desired result.

These functions overlap the highest order functions and must also be undertaken by government. They benefit the Australian people, now and in the future as well as the users of the resources of the marine environment. The cost of these activities should be met initially by the community and, to the extent that users benefit through increased profitability and increased catches, recouped from those gaining private benefits.

The Plan of Management is the vehicle for implementation of the resource management objectives for each fishery. Where input controls are used, it involve controls on inputs which may extend to industry restructuring. There may be some overlap in such cases with fishing industry management which aims to enhance the profitability of the fishing industry. Where restructuring is an aim of management, it should be included in the Plan of Management. Generally, implementation of Plans of Management can be considered to benefit those permitted to fish in a specific fishery. Activities are likely to include (for a purely commercial fishery):

- industry restructuring;
- implementation and delivery of the Plan, including surveillance (but not enforcement, or surveillance undertaken for national purposes) and monitoring (by logbooks or other means);
- administration and licensing; and
- commissioned research.

The beneficiaries of such activities are the commercial fishermen operating in the managed fishery and consequently they should pay 100 per cent of the costs of these activities. If the fishery includes other users, in particular recreational fishermen and charter boat operators, and their activities are encompassed in the Plan of Management, they should bear the costs related to the benefits they receive. In this situation, benefits to these other users is not a by-product (or incidental benefit) of management. Operators of commercial enterprises, such as charter boat businesses, should be treated exactly as commercial fishermen are.

The third level of management is that undertaken at the industry level. Such activities (including `real time' management, marketing and product enhancement, and training) will only be undertaken if they are in the collective interests of the industry and should be paid for by industry. It is possible that this concept could be applied to fisheries with other than commercial fishermen, where collective action is taken on behalf of, say, commercial and recreational fishermen with the aim of improving the total benefits (or decreasing the total costs) of implementing the Plan of Management.

There remains the issue of the cost-effectiveness of collecting the management costs from recreational fishermen. If there are difficulties in identifying recreational users and/or if the costs of policing a licensing system for them is high relative to their contributions to management, the public would need to pay for their management. The Commission proposes a method of payment to facilitate a cost-effective solution to this, one which goes closer to meeting the beneficiary pays principle.

Application of these principles can be seen more clearly when applied to two of the major management functions - surveillance/enforcement and research.

*Surveillance and enforcement*

Surveillance is the monitoring of activities usually undertaken by air flights or boat patrols to ascertain whether foreigners are intruding into national territory, and to determine whether fishermen and others are abiding by rules pertaining to such things as seasonal or area closures. Enforcement is action taken if a suspected infringement occurs, such as detention, arrest and prosecution.

At a very general level, surveillance and enforcement are either elements of, or not dissimilar to, the normal policing functions of the State. The State will aim to protect its borders (in this case the border is the outer boundary of the AFZ) for the benefit of its people. Surveillance and enforcement to prohibit encroachment into the AFZ and to regulate the activities of legal foreign fishing perform this function. They are essentially 'defence of the realm'. The protection this provides to domestic fishermen is only a part of a much more general service to the nation. Such surveillance and enforcement is a public good - if provided for one person in the nation, it is automatically provided for all (non- excludability) and its 'consumption' by one person is not at the expense of its 'consumption' by other individuals.

Just as the nation state protects its citizen from foreign intrusions so it employs internal police forces to protect the life, limb and property of its citizens against illegal acts. The public good nature of internal policing means that it would be under-supplied if left to individuals to pay for their own police forces. It is noted that, in recent times, some businesses (including those holding

sporting events and operating nightclubs/discotheques) are engaging security firms to supplement the work of the police forces of the State. The reasons why this occurs is that there are not unlimited resources for policing, and those willing to pay for additional services must obviously believe the service provided by the normal police forces is inadequate. What these people are paying for is surveillance only. Enforcement (such as detention, arrest and prosecution) is not sanctioned by the State as a private function.

This leads to consideration of who should undertake, and who should pay for, surveillance and enforcement in domestic fisheries. Clearly enforcement is a Government function and, as with other types of enforcement, should be paid for by the community. In practical terms there are economies in having surveillance and enforcement undertaken by the same personnel, but that does not prohibit a separation of the costs between the two functions.

State Government fisheries managers have submitted to this inquiry that surveillance is not different from the normal policing activities of the State and, hence, should be paid for by taxpayers. On the other hand, the Commonwealth presently has a policy of cost-recovery for surveillance. Underlying the view that Governments should provide and pay for surveillance is, amongst other things, a notion of equity. Fishermen in a managed fishery have a form of property right - notwithstanding the fact that the original entrants were given that right by the State, just as squatters were given rights in past eras - and the argument is that they are entitled to have that right protected as other citizens have their property protected.

In terms of this argument much revolves on the nature of the property right. All Australian fishing grounds (with the exception of some oyster grounds) are owned by the community. A fishermen's 'right' to access is subject to constraints. Even in the situation where statutory rights are to be created (as under the AFMA legislation) those rights are conditional and exist only for the duration of a Plan of Management approved by Parliament. On this basis it can be argued that the community as owner of the property should bear the cost of protecting it, while having the right to penalise fishermen who transcend the rules (such as those pertaining to quotas, use of gear and closures) set by society.

A contrary argument to this is that if fishing was not occurring society would have no need to have surveillance undertaken. This would also apply to other users of the marine environment. The problem with this perspective is that it could be applied to every human activity and hence is not a practical approach.

It is somewhat more helpful for analysis to focus on the issue of who benefits from surveillance. Surveillance of a fishery can have two objectives. One is protecting the resource to, say, achieve long term ecological sustainable development. The beneficiaries cross generations, although it must be recognised that this generation of users (fishermen and maybe others) gain some of the benefits. The other objective is to police the management rules which are in place to benefit fishermen directly : rules aimed at prohibiting a particular fisherman causing a cost to his fellow fishermen by, for example, cheating on quota or gear. These are the rules which will be imposed by a Plan of Management. They will exist largely for the benefit of fishermen collectively. The beneficiary pays principle suggests that fishermen should pay for the latter type of surveillance.

There is a graduation of rules which benefit fishermen. Some will focus on addressing the open access problem (ensuring the most profitable amount of effort, and no more, is allowed in the fishery), while others might be aimed at 'real time' management objectives (such as those used in the Spencer Gulf prawn fishery and for the 'Le Mans' start of the banana prawn season in the Northern Prawn fishery) which can be left to fishermen to agree to on a collective basis. If such collective action can be encouraged, fishermen will be able to compare the costs and benefits of such self-imposed surveillance.

By applying the beneficiary pays principle fishermen should have an incentive to engage in self-policing through peer pressure as this would reduce the costs they would have to meet in paying for formal surveillance. To convince the managers that this was lessening the need for outside surveillance there would need to be a form of performance monitoring. Fisherman are likely to seek other ways of reducing the cost of surveillance. They are likely to weigh any increases/decreases in the level of surveillance against the collective benefits. Cost effectiveness will also be of interest to them; for example the use of global positioning systems (GPS) is likely to be advanced.

The surveillance and enforcement system needs to be formulated with a view to deterring infringements. The extent of deterrence will depend on the risk of being apprehended and convicted and the penalty imposed. A given level of deterrence can be achieved by different combinations of risk and the penalty. Finally, the cost of surveillance needs to be taken into account when determining the management regime as some rules are more costly to police than others.

*Research*

Research to better understand stock dynamics and the general functioning of the marine environment is, first, a prerequisite for policy development at the highest level and for policy and Plan of Management formulation. Second, research findings will ultimately benefit commercial fishermen (as a consequence of its application to improving the profitability of fisheries) and other users (for example, by managing stocks for recreational fishermen). These two applications of research indicate that both the community and fishermen are the beneficiaries of research.

The principles of allocative efficiency require that the beneficiaries of research somehow signal to the providers of research how much should be expended on this activity and what types of research should be pursued. For that component of research which benefits the community generally, these decisions have to be made by Government in the context of its responsibility to its citizens.

For that component of research which ultimately benefits private individuals - the private good part of research - the value of research will, or should, be reflected in increased profits (in the case of commercial fishermen and others who provide market goods and services). Before the research is undertaken it will be the *expected* increased profits which reflect the contribution of research. Actual or expected increased profits are likely to be capitalised into the value of access rights to a fishery. A market for such rights will indicate the value of research. Where Governments are in a position to auction access rights (as could be done for new Commonwealth fisheries), the value of research undertaken for the purpose of formulating a plan for a profitable fishery would be reflected in what entrants would pay. The higher access fee would be the fishermen's contribution to the cost of research, as valued by fishermen. In existing Commonwealth fisheries, fishermen

have been granted property rights, making access fees inappropriate. Nevertheless, this means that these fishermen will eventually gain from the research if and when it leads to increased profitability. To the extent that they benefit, they should pay.

A fundamental issue is the separation of the timing of the costs of management activities and their resultant benefits. While there is no separation in time for on-going management activities (such as administering a licence system, collecting and analysing logbook data, and surveillance), there is with implementing a management plan which will only over time lead to a more profitable commercial fishery and, likewise, with expenditure on research now to facilitate the formulation of improved management in the future.

Proposals to spend money on improving management should be considered, and evaluated, as investment decisions. Various activities are involved in improving management of a commercial fishery, but the first and usually most expensive exercise for a management authority is to determine, on the basis of scientific knowledge (complemented with economic analysis), what the level of exploitation should be if the fishery is to become more profitable.

A cost-benefit analysis (or feasibility study) will bring together the stream of costs (high research costs initially, followed by smaller on-going costs) and benefits (low benefits in early years, increasing as profitability rises in later years). Obviously for any particular fishery there may be a range of research options. Some of these will high cost, with a relatively high degree of certainty of providing useful results in the short term. Others will be low cost, such as monitoring catches and effort and analysing trends, with a relatively lower degree of certainty of finding useful results.

As with any other investment decision, the future benefits cannot be known with certainty. The results of research are inherently uncertain. The difficulty of understanding ecological and biological functions in a fishery increase the uncertainty. Lindner (1989, pp. 151-152) argues:

> Unlike other forms of investment, research is by definition characterised by pervasive uncertainty. There is uncertainty about the period of time needed to complete any given project, and there is uncertainty about the cost of doing so but, above all else, there is uncertainty about whether a successful outcome will be achieved or not ... *ex ante* evaluation of ... potential benefits in relation to research costs needs to take account of the uncertainty inherent in the research process as well as the separation of timing of costs and potential benefits.

What this means is that it is the expected net present value of research which is factored into the cost benefit framework. Because the rationale for the type of research being discussed is to improve the profitability of the fishery through improved management leading to a more productive fishery, the share of benefits between fishermen, consumers and associated industries will depend on demand and supply elasticities, and would be modelled in the same way as the BAE (1986) modelled the gains from improved management. The majority of benefits are likely to accrue to fishermen - some time in the future.

Fishermen would not expect to recoup the high costs of investment in research immediately (when they are incurred), just as they would not expect to recoup immediately the capital invested in boats. Given the poor biological and economic state of many Commonwealth fisheries they could not pay immediately, which means that the public, as owner of the resource, will have to fund the research - assuming it is found to be justified by a cost-benefit analysis. The question becomes by what means, and when, should the beneficiaries pay for, what will have to be, publicly funded research. A conceptually valid approach would be to require the beneficiaries (fishermen in this case) to commence to pay when the benefits (increased profits) started to accrue.

Practical considerations - and the potential resource misallocation effect of treating fishermen differently from other beneficiaries of publicly funded research - mean that a pragmatic approach to cost-recovery of some of the expenditure on research is required. This means that fishermen and other users should pay their share over time. These cost recovery arrangements will need to be settled in the process of developing Plans of Management for each fishery.

**Foreign fishing**

As mentioned earlier in this chapter, the benchmark for the anaysis of the costs and benefits of fisheries is taken as the welfare of the Australian people. Hence, foreign fishing is treated differently

If the provision of services and fishing rights to foreigners were at the less than full cost this would represent a transfer to them from Australia. While this is true of foreign owned but Australian domiciled enterprises, it is even more significant for foreign fishing within the AFZ. When

Australian fish are caught by foreign flag vessels and shipped directly, they are not recorded as Australian production - they do not contribute to measured exports or GDP. The only benefits accruing to Australia from foreign fishing activities are through access and management fees and incidental benefits in terms of information, technology transfer and marketing. If fishing is not undertaken on a long term sustainable basis, the costs would include the depletion of the stock and any environmental damage.

Submissions were made that some foreign fishing ventures had imposed net costs on Australia rather than bringing net benefits. To avoid such an outcome it is important that all management services be charged at full cost and that the Commonwealth ensure that incidental benefits promised are received by means such as foreign funding of observer or training programs. Given the emphemeral and footloose nature of distant water fishing, services should be charged for during the period in which they are provided.

It is also important that the access fees extract as much as possible of any rents accruing from the resource. From Australia's point of view, it is of little benefit if a foreign fishing venture is technically more efficient than an Australian one if the rents accrue in a foreign country.

# 3 THE AUSTRALIAN FISHERIES MANAGEMENT FRAMEWORK

The management of fisheries under Commonwealth control involves many different Commonwealth organisations as well as State Governments and the Northern Territory. The complexity of the relationship among these organisations, and the suitability of the jurisdictional arrangements, affect the costs and effectiveness of fisheries management.

## 3.1 The Australian Fishing Zone

Two jurisdictional changes have had a significant impact on the institutional framework. First, the 1977 United Nations Convention on the Law of the Sea (UNCLOS) extended the limit of Commonwealth jurisdiction from 12 nautical miles out to 200 nautical miles. Second, there has been an evolving jurisdictional relationship between the Commonwealth and the States as a result of the 1983 Offshore Constitutional Settlement (OCS). The consequence of both of these changes is that the total size and composition of the fisheries managed by the Commonwealth has altered significantly. The Commonwealth must constantly interact with the States to enable the negotiation of the OCS, the joint management of a number of fisheries, and the use of the relevant State departments to carry out management related activities.

When Australia acceded to the UNCLOS, it accepted certain responsibilities for managing the AFZ. Article 62 of the treaty specifies that:

> The coastal State shall promote the objective of optimum utilization of the living resources in the exclusive economic zone without prejudice to article 61.

Article 61 says:

> The coastal state, taking into account the best scientific advice available to it, shall ensure through proper conservation and management measures that the maintenance of the living resources in the exclusive economic zone is not endangered by over-exploitation....

In 'New Directions', the interpretation of the Department of Primary Industries and Energy (DPIE) was as follows:

> International law allows a nation to regulate the fishing activities of its nationals anywhere in the world and gives a coastal nation sovereign rights over all fishing activity within its 200 nautical mile fishing zone. The nation is responsible for conserving the living resources in this zone and for the optimum use of those resources, which gives rise to an obligation to allow foreign fishermen to take that part of the TAC which that country's fishermen are unwilling or unable to take.

Prima facie, this interpretation places insufficient emphasis on the requirements to determine, and if necessary revise, the appropriate level and type of exploitation within the Exclusive Economic Zone. Articles 61 and 62 place an obligation on the coastal state to reduce the TAC if there is over-exploitation.

The obligations to other countries under UNCLOS, were summarised by the Department of Foreign Affairs and Trade (DFAT):

> ... the coastal State has the exclusive right to determine the total allowable catch as part of its obligation to promote the objective of optimum utilization of the living resources in its zone. Also exclusive to the coastal State is the determination of its own capacity to harvest the total allowable catch (TAC), it has the obligation to give other States access to the surplus of the allowable catch, subject to the relevant factors, including inter-alia, the significance of the living resources of the area to the economy of the coastal State concerned and its other national interests.

Compared with other coastal states Australia has few international jurisdictional problems because the AFZ is contiguous with only a few others. Whether to allow distant water fishing nations access to the AFZ is the most important international issue.

The Commonwealth allows access to foreign fishing nations under agreed terms. Details for specific fisheries are contained in Appendix H. In the bilateral fishing agreement with Japan, the Japanese continue to be allowed to purchase the right to fish for southern bluefin tuna in the AFZ, despite the over-exploited status of the stocks.

There are also a number of other bilateral agreements which allow foreign vessels conditional access to fish in the AFZ, and also agreements which allow Australians to enter into cooperative fishing ventures with foreign interests using foreign fishing boats. Some details of these are given in Appendix H.

**Commonwealth - State jurisdiction**

Jurisdictional problems have inhibited the effectiveness of Australian fisheries management since its inception. Responsibility for managing the marine resources within the AFZ is divided in practice between the Commonwealth and the States. The Commonwealth jurisdiction covers the area extending from 3 nautical miles from the coastline to the limit of the AFZ. Thus the same fish stock can be under the jurisdiction of both a State and the Commonwealth, or more than one State and the Commonwealth. The Commonwealth has jurisdiction over sedentary organisms in the Continental Shelf. Special arrangements apply for the Torres Strait Protected Zone (TSPZ).

In an attempt to rationalise the split between State and Commonwealth fisheries, the OCS was developed and implemented in 1983. It provides for four management categories:

1. Joint authority management. The Commonwealth and one or more States can form a single entity which manages a fishery or fisheries under a single law, either Commonwealth or State.

2. State management. Where a fishery is located off only one State, arrangements can be made to manage that fishery under State law.

3. Commonwealth management. Where a fishery is adjacent to more than one State the fishery can, by agreement between the parties, be managed solely by the Commonwealth; for example, the Southern Bluefin Tuna (SBT) fishery.

4. Status quo management. In fisheries where no OCS management arrangements have been agreed, status quo arrangements provide for State control over coastal waters (to 3 nautical miles from the shore) and Commonwealth control over proclaimed waters (3 to 200 nautical miles from the shore). One example is the South East Trawl (SET) fishery.

The Commonwealth is also involved in the management of other types of fisheries: the Great Barrier Reef Marine Park which is managed by the Great Barrier Reef Marine Park Authority, the whale conservation 'fishery' managed by the Australian National Parks and Wildlife Service (ANPWS) and the Torres Strait fishery jointly managed by Papua New Guinea and Australia through the Protected Zone Joint Authority (PZJA) (refer Appendix H).

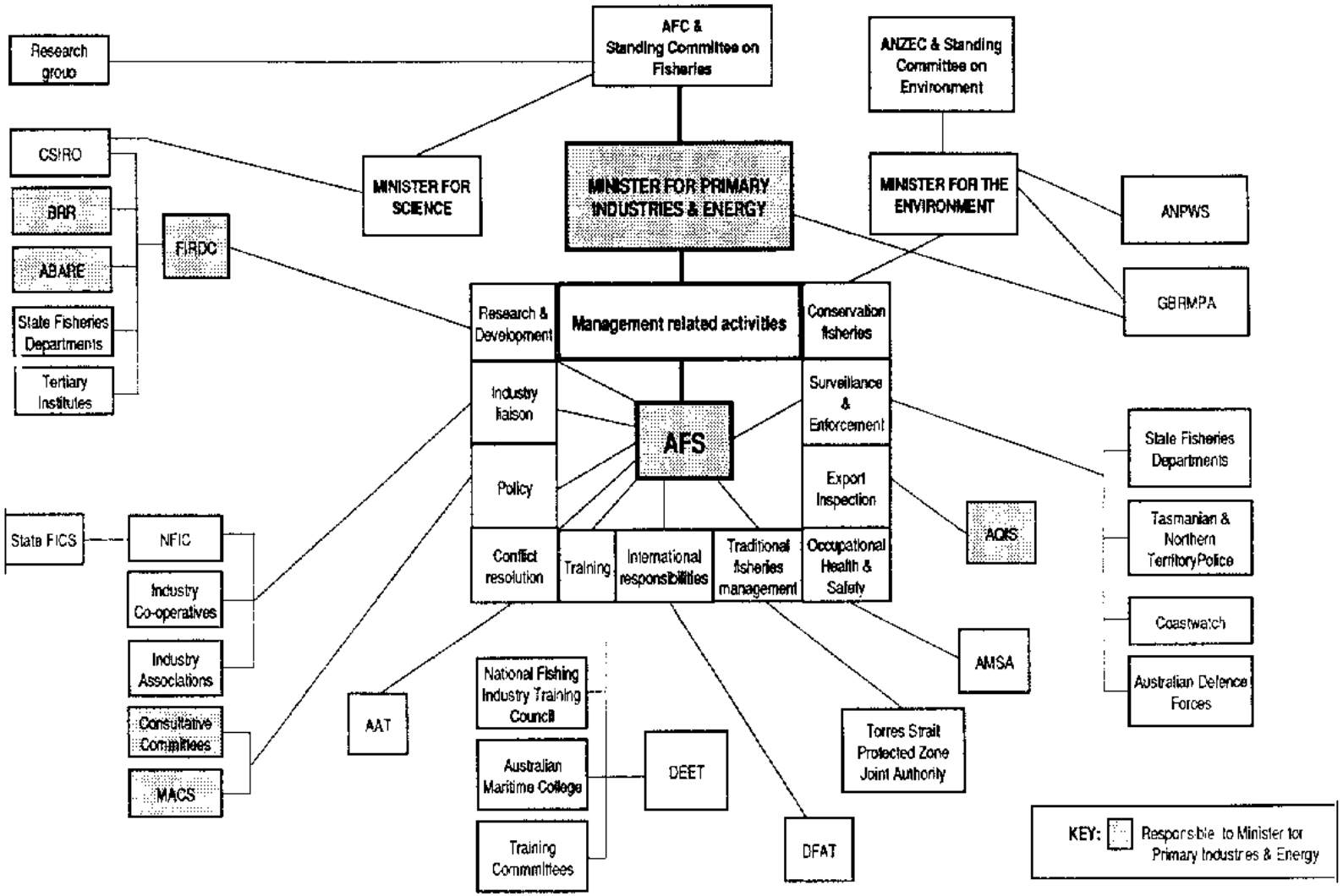
While the OCS has overcome many jurisdictional problems a number still remain. There are jurisdictional issues not settled by the OCS, or yet to be settled by the OCS, which can require negotiation and may also be the source of conflict between the Commonwealth and the States. For example, OCS arrangements have not yet been successfully finalised between the Commonwealth and New South Wales. Even where OCS arrangements are in place, there are differences in approach between the Commonwealth and the States that can adversely affect both fish resources and the fishing industry. A recent example is the management of reef fish which inhabit waters both within the jurisdiction of the Northern Territory and the adjacent Commonwealth waters. The Fisheries Division of the Northern Territory Department of Primary Industry and Fisheries, said that in 1990 the Commonwealth issued trawl licences to target these resources without any research to investigate the effects on the existing Northern Territory trap and drop-line reef fin fishery. As trawl fishing is a much more powerful form of fishing the impact on the Territory's fishery may be substantial.

The Commonwealth and the States have to interact for other reasons. The States carry out management related activities, mainly research and surveillance and enforcement, on behalf of the Commonwealth which require an amount of negotiation.

## 3.2 Current institutional framework

The management of fisheries under Commonwealth control goes well beyond the responsibilities of the Department of Primary Industries and Energy. All of the States, the Northern Territory, and a number of Commonwealth agencies are involved. Figure 3.1 depicts, at a broad level, the organisations involved and the linkages. The Commonwealth has recently enacted new fisheries legislation and certain institutional changes are part of this. This report represents the new arrangement as the Commission understands them to be at the time of writing.

Figure 3.1: **Organisation links in Commonwealth fisheries**



The key Commonwealth bodies concerned with commercial fishing are: AFS/AFMA, CSIRO, the Bureau of Rural Resources (BRR), and the Australian Bureau of Agricultural and Resource Economics (ABARE). Agencies with specific roles are: the Australian Quarantine Inspection Service (AQIS), the Australian Maritime Safety Authority (AMSA) and the Administrative Appeals Tribunal (AAT). Certain functions of the AAT are to become the responsibility of the new Statutory Fishing Rights Review Panel. The Great Barrier Reef Marine Park Authority (GBRMPA) and the Australian National Parks and Wildlife Service (ANPWS) have responsibilities for managing certain marine ecosystems and species.

Turning to the private sector there are over two dozen industry organisations involved with Commonwealth fisheries management. They include peak councils like the National Fishing Industry Council (NFIC) and its associated State councils, and specialist groups such as the Tuna Boat Owner's Association (TBOA) and the South East Trawl Fishing Industry Association (SETFIA). These groups provide collective services for their members and represent them in the many government/industry groups which are set up for specific purposes.

The final category is Government-industry groups. They include the Management Advisory Committees (MACs) which are closely involved in individual fisheries management decisions, as well as on-going groups which focus on particular management activities such as research, and groups set up for short-term consultations on particular issues, such as the Ecologically Sustainable Development Working Group.

Below is a description of the major Government bodies involved in the management of Commonwealth fisheries.

**Australian Fisheries Council**

At a policy level the interaction of the Commonwealth and the States is facilitated by a ministerial council, the Australian Fisheries Council, and a standing committee of officials, the Standing Committee on Fisheries. Members of the Council include: the Commonwealth Ministers for Primary Industries and Energy, and Science and Technology, and; each of the State Fisheries Ministers. There are also two non-member participants, the Ministers for Fisheries from Papua

New Guinea and New Zealand. The Victorian, New South Wales and Northern Territory Fisheries Ministers are also Ministers for the Environment. The Australian Capital Territory Environment Minister is also a member of the Council.

Given the broad nature of modern fisheries management, in particular the interdependencies between fishing activity and ecological functions of the marine environment, there is obvious value in having environment Ministers involved. In this context, one notable omission is the Commonwealth Environment Minister.

The Standing Committee on Fisheries consists of the heads of: AFS, the Department of Foreign Affairs, all of the State and Northern Territory Fisheries Departments or Divisions, the CSIRO Division of Fisheries and the Australian Capital Territory Department for the Environment and Conservation. Non-member participants include the Assistant Director-General of New Zealand's Ministry of Agriculture and Fisheries, and the Secretary of Papua New Guinea's Department of Fisheries and Marine Resources.

The research committees, discussed below, are directly responsible to the Standing Committee.

**Australian Fisheries Service**

AFS, a division of DPIE has administered all Commonwealth managed commercial fisheries. Its management activities have required it to be involved with many separate organisations. Its functions were established by the *Fisheries Act 1952*. It is to be replaced under the new fisheries legislation by the Australian Fisheries Management Authority (AFMA), the Fisheries Research and Development Corporation (FRDC), and a Fisheries Policy Branch within the Department of Primary Industries and Energy. Given the management objectives stated in the Act, AFS's primary function has been the management of commercial fisheries. Management objectives and plans had to be consistent with the over-riding principles in the Act, which pertain to resource management and the efficient utilisation of the fishing grounds and resources applied to fishing.

To meet these goals a range of activities have been undertaken by, or on behalf of, AFS. They include: policy development, allocation of access rights, licensing, management of logbook programs, research, surveillance and enforcement, and extension. The ultimate decision on policy matters and access by foreign fishermen rests with the Commonwealth Minister for Primary Industries and Energy.

Some management functions have been undertaken directly by AFS, some under contract to AFS, and others have been delegated to Management Advisory Committees (MACs). Under the existing arrangements MACs haqve been established by AFS; they can advise the Minister for Primary Industries and Energy directly. For those fisheries which do not have established MACs other advisory committees exist.

The main activities which AFS has undertaken itself include: development of fisheries policy, licensing of boats which are allowed to fish in Commonwealth fisheries; development and implementation of management plans for fisheries, management of logbook programs, various elements of which are contracted out; extension services, to the extent that it publishes the 'Australian Fisheries' magazine and newsletters in each fishery, and undertakes port visits conducting public seminars; development of restructuring policies; and negotiation, in conjunction with the Department of Foreign Affairs and Trade, with foreign nations for access to the AFZ.

Major activities which are a direct responsibility of the Commonwealth, but which have not not been undertaken directly by that AFS, are surveillance and enforcement. These activities are predominantly undertaken by State/Northern Territory agencies on behalf of the Commonwealth. Continuing negotiation and consultation with the States and the Northern Territory is required to organise surveillance and enforcement.

Surveillance of illegal entry to the AFZ is undertaken by Coastwatch and the Australian Defence Force (ADF). The primary objective of this latter surveillance and enforcement is 'defence of the realm' and fisheries matters are a subsidiary element.

One very important management-related function over which AFS has had little direct control is research. While two of its sources of research information, ABARE and BRR, are within DPIE, they are independent bureaus. The other major sources of research, CSIRO and State organisations, are almost completely divorced from AFS (these are discussed below). In practice, CSIRO is not completely divorced from AFS as there have been memoranda of understanding outlining the research that CSIRO will carry out for the AFZ.

## The Australian Fisheries Management Authority

The *Fisheries Administration Act 1991* establishing the Australian Fisheries Management Authority (AFMA) was passed by Parliament in October 1991. It is anticipated that the Authority will be set up in February 1992.

Many of the elements of fisheries management will no longer be carried out by the Department of Primary Industries and Energy (DPIE), but by an autonomous statutory authority, AFMA. As it is not considered desirable for a statutory authority to be responsible for certain policy functions, a policy cell within DPIE is to be established to undertake Government functions.

AFMA will be run by a board appointed by the Minister for Primary Industries and Energy.

The Board members have diverse areas of expertise. The Chairman has an extensive background in public policy and administration, there are two members from the commercial fishing industry, and another member has a background in business and finance. There is a Government representative and a marine ecologist.

## Research organisations

Research agencies can be divided into those which actually conduct research, such as CSIRO, and those which fund or scrutinise research results such as FIRDC and BRR.

The majority of research funding for Commonwealth fisheries is by direct appropriation from the Government, or through FIRDC. AFS has had little funding to commission research directly. As a consequence there has been a constant need for liaison with the various research organisations.

What research has been initiated by AFS, or the MACs under it, is funded mainly through management levies or through separate research levies in the case of the Northern Prawn and orange roughy fisheries.

The State fisheries research institutes are significant contributors to research related to Commonwealth fisheries. Many of their programs pre-date the OCS arrangements. Thus, most of the research involved in setting TACs apart from orange roughy, was conducted by the States. Most of this research was funded by the States, with some contribution from FIRDC and FDTA.

*Fishing Industry Research and Development Council*

The Fishing Industry Research and Development Council (FIRDC) was established under the *Fishing Industry Research and Development Act 1987*. Its objectives under the Act were to identify the areas of need for fisheries research and development (R & D); improve the efficiency and effectiveness of R & D; and improve the accountability for expenditure on fisheries R & D. In order to meet these objectives it allocated funds on a grants system by application, or in response to specific requests (for example, National Consumption Survey, compilation of national fishery statistics).

To assist in the determination of which organisation and projects were to be allocated funds the Council was required to undertake certain functions. These included investigation and evaluation of the general requirements for fisheries R & D, preparation of R & D plans for each financial year (which had to be approved by the Minister for Primary Industries and Energy), and monitoring and reporting to the Parliament, the Minister, and the Fishing Industry Policy Council of Australia on fisheries R & D projects which were funded by FIRDC. Under the Act it was also required to prepare a 5 year strategic plan, to be approved by the Minister, and an annual report which had to be tabled before Parliament.

The research council had, in its 5 year plan, the stated objective to initiate, stimulate and foster research and development proposals from the following:

- Standing Committee of Fisheries and the National Fishing Industry Council of Australia;
- Research and development organisations or from individual researchers;
- workshops or conferences, either sponsored by FIRDC or by organisations such as the Bureau of Rural Resources, Fisheries Resources Branch;

- industry/government management authorities or bodies, eg Northern Prawn Fishery Management Committee (NORMAC);

- fishing industry associations, fishing industry companies and aquaculture companies; and

- individual fishermen and others.

There was little funding allocated by FIRDC to any organisation other than CSIRO, the State fisheries departments, BRR and ABARE. In other words, there has been little direct funding to tertiary educational institutions, industry and private individuals.

FIRDC was separate from AFS, but its trust account was administered by a separate secretary located within the APS, and the Director of AFS did sit, as the government representative, on the board of FIRDC. The trust account was totally funded by the Commonwealth (see Chapter 4).

Any appointment to the Council Board had to be approved by the Minister, and the Minister appointed the Chairperson and Government Member on the Council Board.

FIRDC was disbanded in September 1991, in anticipation of its replacement by the Fisheries Research and Development Corporation (FRDC).

*The Fisheries Research and Development Corporation*

The evolution of the principle autonomous research priority setter is about to enter another stage. FIRDC's parallels in other rural industries have already been disbanded in favour of research corporations, and this is about to happen in the fishing industry, as FIRDC is to be replaced by FRDC.

The main differences expected between the corporation and its predecessor are that firstly the funding arrangements will change (see Chapter 4), and secondly the capacity will exist for the corporation to change its profile relative to the council. This includes the option of attaining a separate office and administration from the management authority. It is also intended that under the new arrangements industry will have more involvement in setting R & D directions. It is not yet clear to what extent the other research mechanisms (discussed below) will be co-ordinated by or integrated into the activities of the corporation.

The requirements concerning disclosure, authorisation, accountability and board appointments will remain unchanged.

At the time of writing, while the legislation enabling FRDC to come into operation had been passed, final arrangements such as the appointment of a chairman and the board remained incomplete.

*CSIRO*

The CSIRO Division of Fisheries is the Commonwealth's principal fisheries research organisation. It is responsible to the Minister for Science and Technology. It has its headquarters in Hobart and marine laboratories in Queensland, Western Australia and Jervis Bay.

CSIRO undertakes various types of research. It undertakes tactical and strategic applied research on marine ecosystems, commercial fisheries and aquaculture. CSIRO also undertakes research which is directly related to fisheries management. It is also involved in a wide range of research pertaining to such matters as marine pollution and use of the coastal zone. Some of this research has the potential to assist fisheries management.

While there has been memorandums of understanding between AFS and the CSIRO Division of Fisheries since 1979, which allowed AFS to commission specific research for the Commonwealth fisheries, and a deal of cooperation between the two, AFS has had little money to commission research in its own right. CSIRO obtains the majority of its funds from direct Commonwealth appropriation. About 35 per cent of its fisheries research funding comes from external sources such as FIRDC and FDTA. This means that AFS has to rely on CSIRO fisheries research but has little direct say on the type and amount of research, apart from the limited amount which it commissions.

*Bureau of Rural Resources*

BRR is a biologically oriented research agency within DPIE and is directly responsible to the Minister for Primary Industries and Energy.

BRR submitted that its major tasks in the area of fisheries management are:

- to advise the Minister and AFS/AFMA on the status of Commonwealth managed fisheries resources and on related environmental and technological issues;
- to monitor the stock condition of designated fish species;
- to assist fishery managers in developing priorities for management related biological research; and
- to provide research on a contractual basis to assist management programs.

In carrying out its roles, BRR uses research information obtained from CSIRO and other agencies including the State research institutions. It also utilizes logbook data gathered by or for AFS.

*Australian Bureau of Agricultural and Resource Economics (ABARE)*

ABARE is an economic research bureau involved in agriculture, forestry, fisheries, minerals and energy. It is part of DPIE.

ABARE's work includes:

- market outlooks - analysing market developments for the main fisheries products and forecasting movements in prices and trade; and
- production issues - analysing proposed and current fisheries management, to identify any avoidable problems in the use of resources and to improve the efficiency and productivity of the fishing industry.

It conducts economic and bio-economic studies relating to fisheries. As the fisheries section of ABARE is heavily reliant upon outside funding, the focus of these studies is usually short term consultancies on management related issues.

*Other research organisations*

Various organisations are involved in fisheries research. They include tertiary educational institutions and the Australian Institute of Marine Science. The research program and allocation by the Great Barrier Reef Marine Park Authority (GBRMPA) also incorporates some fisheries research. Universities undertake only a minor part of commercial fisheries research.

Some specific research is undertaken for research committees formed by, but not responsible to, MACs. They report directly to the Standing Committee on Fisheries and give advice to MACs. Research groups are formed to facilitate this type of research.

**Other organisations with specific roles**

*Australian Quarantine and Inspection Service*

AQIS is an authority within the DPIE with the task of safeguarding Australian primary industries from pests and disease, and improving the prospect of the marketing of their products. It achieves its mission by ensuring that products are safe, wholesome, accurately described and comply with the requirements of importing countries.

The purpose of AQIS export inspection is to provide other countries' quarantine authorities with the confidence that exported commodities will be wholesome, fit for human consumption and accurately labelled and not carry diseases into the importing countries.

*Administrative Appeals Tribunal*

Appeals can be made to the AAT with regard to licensing decisions or allocation of fishing rights. AAT decisions have over-ridden those made by AFS, notwithstanding the fact that the AAT does not have the appropriate fisheries science expertise.

*The Statutory Fishing Rights Review Panel*

Under the new arrangements (see section on AFMA above) the Administrative Appeals Tribunal (AAT) will retain responsibility for considering appeals as to whether an individual satisfies the conditions specified in a Plan of Management for entry into a fishery.

However, appeals about the manner in which the available fishing rights are to be distributed among those fishermen who satisfy the entry conditions will be considered by the Statutory Fishing Rights Allocation Review Panel. This panel will be quite separate from the management authority. Each case will be reviewed by three members: a principal member appointed by the Minister; and two other members chosen by the principal member from a panel of members

*Great Barrier Reef Marine Park Authority*

GBRMPA is a statutory authority within the portfolio of the Commonwealth Environment Minister. A Commonwealth/Queensland Ministerial Council consisting of the Commonwealth and Queensland State Ministers for Environment and Primary Industries oversees its operations. Zoning plans have to be approved by the Commonwealth Parliament.

The Great Barrier Marine Park is a Commonwealth managed multi-use area covering an area of 345 000 square kilometres off the Queensland east coast. The Great Barrier Reef Region was specifically excluded from the OCS arrangements, except with regard to fisheries.

GBRMPA has a charter to manage the use of the Marine Park according to the broad principles of ecologically sustainable development. Any use such as commercial or recreational fishing and tourism, which do not threaten the ecosystem, are permitted. These are managed by zoning plans, regulations and a permit system. GBRMPA does not involve itself in commercial or recreational fisheries management per se, which remains the responsibility of Queensland. Nevertheless, through zoning, some gear restrictions and long term closures of areas it does influence both commercial and recreational fishing.

Management of the Marine Park, is to date, the best example of comprehensive and co-ordinated resource management within the AFZ.

GBRMPA is to manage marine and estuarine protected areas (MEPAs) being established around the northern part of Australia. ANPWS will manage MEPAs around the southern part of Australia. These areas are being established as part of a decade long national marine conservation strategy, announced by the Minister for the Arts, Sport, the Environment, Tourism and Territories in August 1991.

*The Ecologically Sustainable Development Working Group*

Ecologically Sustainable Development Working Groups dealing with various sectors of the economy were established by the Commonwealth Government in 1990. These groups were to be guided by the following four fundamental goals:

- the improvement of individual and community well-being and welfare by following a path of economic progress that does not impair the welfare of future generations;
- the provision of equity within and between generations; and
- the protection of biological diversity and maintenance of ecological processes and systems.

The fisheries group published its report in November 1991.

*The Australian National Parks and Wildlife Service*

ANPWS is a statutory authority in the Commonwealth Environment portfolio. With regard to fisheries matters, it enforces the *Commonwealth Whale Protection Act 1980* which prohibits the killing, injuring, taking or interfering with all whales, dolphins and porpoises by all persons within the AFZ and by Australians anywhere in the world. It is also involved in protection of endangered marine animals and in the development of new marine parks in the AFZ.

As mentioned above ANPWS is to manage the marine and estuarine protected areas (MEPAs) around the southern areas of Australia.

*Australian Maritime Safety Authority*

The Australian Maritime Safety Authority (AMSA) was established on 1 January 1991 as a statutory authority to enhance efficiency and contain costs in the delivery of safety services to the Australian maritime industry. AMSA provides navigational services, and ship and personnal safety services. It coordinates marine search and rescue, and is responsible for administering the the

National Plan for combating pollution of the sea by oil. It provides services relating to the employment of seamen and has a shipping registration service. It also provides the radio communications system for licensed foreign fishing vessels.

## 3.3 Regulation of commercial fishing

Notwithstanding the fact that Australia has been a world leader in applying fisheries management techniques (such as limited entry and associated input controls), prior to the 1970s the Commonwealth itself did not have a significant involvement and, therefore, a role in applying these techniques. The Commonwealth accepted the regulatory framework of the adjoining State. Commonwealth management has therefore not developed from a 'green fields' situation, but bears the legacy of both the past management frameworks and open access. This has not made the Commonwealth's task easy.

### Access to fisheries

The *Fisheries Act 1952* provided for a number of different, annually renewable licences for domestic fishing. These were the Master Fishermen's Licence (MFL), the Commonwealth Fishing Boat Licence (CFBL), a Carrier Boat Licence, which applied to a boat to which fish are transferred after catching by another boat, and a Processor Boat Licence. A boat could be licensed for one or more of the activities of fishing, carrying or processing. There were also provisions for the licensing of foreign vessels.

The Commonwealth permitted fishing in its fisheries only if a CFBL was held. In managed fisheries, fishing was only allowed if licences were endorsed, or other special conditions were met. As there are a limited number of endorsed licences they have become valuable assets, fetching considerable prices upon transfer.

In general terms, under the *Fisheries Act*, fishermen were allowed to fish without endorsements unless it was specified that a particular fishery was closed. Under the new AFMA legislation the situation will be reversed. That is, fishermen will need to be endorsed to fish in any fishery, except those that have been proclaimed open.

The high price which licences and endorsements fetch suggests that they are considered property rights. Various studies of fisheries, dating back to the time when limited entry regimes were first implemented, have reported licences and endorsements being traded at significant prices. For example, Appendix H Table H.7 shows a time series of prices paid for endorsements into the south-west sector of the South-East Trawl (SET) fishery. These prices reached $200 000. In addition, fishermen are required to invest in boat units and Commonwealth licences. For example, the South East Trawl Fishing Industry Association (SETFIA) have submitted that during 1990, for entry into the SET the total investment, for a typical 30 metre boat, would be $4.81 million, $1.81 million of which would be needed to purchase 'boat units' (see Appendix H), a CFBL and endorsements to the three sectors within the SET. This is a considerable investment and seems to indicate that fishermen expect these access rights to be perpetual.

In recognising this significant investment SETFIA expressed concern about future access:

> The current risk and uncertainty about future access rights is a major concern as, in the absence of catch history, any future re-allocation of fishing rights could see the value of the investment disappear.

In contrast, Dougal Macdonald (Macdonald 1991) has expressed concern over the recognition of licences (or statutory rights, as they will become known under the new Fisheries Management Bill) as property rights:

> If rights are not granted for a finite term as a conscious act of policy implementation, obviously they will, unless the Act is repealed or the management plan is revoked or the holder fails to pay the annual levy, be perpetual.
>
> This would be a bad thing. Rights to harvest a wild resource belonging to the community should be subject to a review/justification process at the end of a known period of currency.

Macdonald cites the Northern Prawn as an example of a fishery where a number of people held unused entitlements for the sake of their value. Macdonald states that getting them out cost active fishermen a considerable amount of money and took considerable time. He recommends that a

new system should be designed to stop that happening again, suggesting either a requirement for management plans to give a finite life-span to statutory rights, or alternatively, including a clause in the legislation making all statutory rights valid for a fixed period of time.

A key issue behind the debate about whether or not licences should represent perpetual access rights is the issue of 'grandfathering'. Fishermen are prone to argue that because of their contribution to the development of a fishery (exploration and, if economic quantities of fish are discovered, investment in boats and gear) they have 'earned' the access rights. The investment by fishermen in developing new fisheries differs according to the fishery. Those who are grandfathered-in obtain windfall gains once limited entry is introduced. Presently those required to pay for access consist only of new entrants who purchase access rights from those already holding them, and foreign fishermen who pay annual access fees.

This issue of access rights was resolved by the enactment of the new statutes (discused below). *New Directions* discussed the past system thus (p. 30):

> Currently the nature of access rights are poorly defined ... While it is reasonable for fishermen to expect that a licence will be renewed each year, there is no guarantee of this .... The Government accepts that it has responsibility to set out the conditions attached to fishing access rights as clearly and simply as possible.

Of particular significance is the statement in *New Directions* that:

> The Government has also decided to formally recognise the ongoing nature of rights in existing developed fisheries.

Given this statement it is not surprising that fishermen have invested so heavily in licences, endorsements and units of ITQ.

However, it must also be recognised that in February 1987, the then Minister for Primary Industries and Energy, John Kerin, recommended to fishermen that they not invest too heavily in ITQ.

Under the new *Fisheries Management Act 1991* it is stated that whilst a management plan remains in place access rights will be maintained.

## Management plans

Under AFS, fishing controls were implemented using either a 'management plan' or 'notice'. A management plan was used when detailed management was required. A management plan contained all the necessary information about the fishery including a description of the fishery either by area, species or fishing method used, or some combination of these. It also contained all the rules of the fishery and described what the fishing access right was, including any conditions such as constraints on transferability. The contents of a management plan were developed by a consultative committee or group involving fishing industry representatives.

A notice was a regulatory instrument for implementing basic regulations, usually opening and closing a fishery, where a detailed management plan had not been prepared or was not appropriate. Fisheries notices can cover most management controls including the prohibition on all or particular types of fishing and control of fishing boats and equipment. There was also power to provide exemptions from these notices.

Under the new legislation there is provision for temporary management measures to be implemented at short notice.

## Management measures

Commonwealth fisheries management uses a mix of instruments. They vary in their effectiveness in controlling catches and in their impact on effort. The management costs associated with each type of measure also differ markedly. The choice of measures used depends on the circumstances in a particular fishery - there is no best single instrument for all purposes.

### *Biological*

Biological controls are used to protect breeding and nursery grounds, to limit the catch of immature stock, and to generally protect stocks. Such controls are in the long term interests of fishermen as well as attempting to meet more general resource management criteria. The traditional measures used are: seasonal closures; area closures; gear size or gear type limitations; and setting a total

catch limit. In most trawl fisheries a minimum mesh size is used to allow escapement of pre-spawning age fish. In prawn fisheries, on the other hand, juveniles are protected either by seasonal closures or by prohibiting fishing in the nursery ground.

Biological controls are often used as adjuncts to other management techniques. By themselves, biological controls only address conservation of the fishery resource. If not applied universally, some of these measures (such as area closures) do not protect stocks as greater pressure is put on other fisheries.

The Northern Prawn fishery is a good example of the combined use of biological and input controls. The fishery is closed for two periods of the year. The summer closure is to allow the banana prawn stock to grow to its most valuable size before exploitation. This is termed eumetric fishing, and, in this case, is in the short term financial interests of fishermen. Therefore the variation and restriction in age of first capture must be considered an input control as is the control of fishing effort.

The winter closure provides some protection to tiger prawn stocks prior to spawning. In addition, daylight trawling is banned during August, September and October to reduce fishing pressure on female tiger prawns which are thought to be more active than males during daylight. There are also seasonal and permanent closures of specified nursery grounds to protect juvenile stocks.

*Output controls*

Output controls are a direct means of controlling total catch. The two main mechanisms of this type used in Australia are competitive global TACs and individual transferable quotas (ITQs). These are vastly different in terms of their impact on fishermen's behaviour.

Competitive TACs are presently in use in the orange roughy fishery and were used in 1987 in the gemfish fishery. Under a competitive TAC fishermen are encouraged to race for the catch, resulting in over-capitalisation and inefficient use of other inputs. This means that the type of control is nothing more than a biological control

Under the ITQ system the TAC is divided into units which are allocated to, or acquired by, fishermen. Each fisherman has a 'claim' to attempt to catch and land a certain percentage of the

TAC; alternatively fishermen vie for a given quantity of fish. The rationale for individual quotas is that they allow fishermen to make economic decisions on how best to take their quotas in much the same way as a farmer determines the best combination of inputs to exploit his land. Whether ITQ management will be a more efficient regulatory system than others will depend on the nature of the fish stocks. In particular, much depends on how large the natural variation in the stock is and what state the stocks are in at the time the ITQ system is introduced. Both of these factors have implications concerning the stability of the TAC. History has proven that equity and investment problems arise if an ITQ system is introduced in a situation whereby the TAC is highly variable (see SBT details in Appendix H).

It may also be that the speed and degree of rationalisation expected from the system is not as great as expected. This is firstly because of the large intrinsic gain that some fishermen attain from their lifestyle. Secondly, the transfer of units of quota will be reduced as a consequence of the limited number of alternative uses for vessels.

ITQs are presently used in the SBT fishery (see Appendix H), and the Gemfish fishery (within the SET, see Appendix H).

It is Commonwealth Government policy to introduce ITQs wherever practical. There are proposals to introduce ITQs for 16 species in the SET, and their use in the Northern Prawn fishery is also being investigated. This is in response to the failure of input controls in this fishery to constrain fishing effort and over-capitalisation.

A fundamental aspect of an ITQ system is that the total cost of restructuring an over-capitalised fishery is placed on the industry itself. Differences of opinion exist with regard to the effectiveness of ITQs and their suitability for some fisheries. Fishermen are divided on these issues, as are managers and fisheries economists.

*Input controls*

Input controls, in the form of limited entry and gear controls, are presently widely used in Commonwealth fisheries. Input controls have failed to control fishing capacity in some fisheries and without an effort reduction programme (such as buy-back) they do nothing to reduce effort in

an already over-capitalised fishery. As a consequence, output controls, in the form of ITQs, have become the favoured management technique.

Input controls have remained in favour in State fisheries to a much higher degree than in Commonwealth fisheries. In the States, output controls are used for the abalone fisheries only. The view of Queensland fisheries managers illustrates some of the reasons for preferring input controls. The Queensland government suggested that the types of fisheries under their jurisdiction are better suited to input controls because they are predominantly inshore, multi-species fisheries with fishing grounds for each species dispersed over large areas of the State's coastline. The commercial fishing fleets targeting these species are characterised by a large number of relatively small, independent operating units with access to a relatively large number of ports for landing product, which would make output controls hard to police. Multiple endorsements also allow fishing units to alternate their effort over a range of fisheries. The Queensland State Government submitted that:

> The unique characteristics of Queensland's fisheries place enormous constraints on applying output control management strategies. Therefore management of fish stocks is achieved primarily through input controls such as limited entry, gear restrictions, size limits and area and season closures as the principal means of regulating effort in the various fisheries.

## 3.4 Management of recreational fishing

Under the *Fisheries Act 1952*, AFS was not given the power to regulate recreational fishing. In Commonwealth fisheries this was left to the adjacent States.

With the new management legislation, AFMA will have the legal power to control recreational fishing. As the Australian Recreation & Sport Fishing Confederation (ARSFC) noted, AFMA is required to give 'adequate consideration to recreational fishing interests' in its management of fishing within Commonwealth jurisdiction.

The ARSFC has proposed that a Bureau of Recreational Fishing be established, funded by industry, government and anglers, with the aim of managing recreational fishing and restoring recreational fishing resources. According to the ARSFC, 14 Commonwealth and around 32 state authorities have responsibilities relating to recreational fishing.

The main aspects of successful management of recreational fishing are research, controls such as bag limits, seasonal and area closures, the education of anglers, and enforcement. Education mainly entails making anglers aware of the restrictions. It also includes information on tag and release methods. Education is particularly important because of the difficulty and cost of policing.

A major problem in the management of recreational fisheries arises from Commonwealth/State jurisdictional separation of ecologically unified fisheries. There is only limited scope for improvement in management while this problem is unresolved. Excluding arrangements in the Torres Strait Protected Zone and the Great Barrier Reef Marine Park, Commonwealth fisheries management has been dominated by commercial fishing, without great consideration being given to other uses such as recreational fishing. State fisheries managers have been more concerned with resource management for multiple uses, including recreational fishing.

The Australian Fishing Council has established the National Recreational Fishing Working Group to report to it on recreational fishing in Australia. A preparatory report will be presented in January 1992. The working group's terms of reference require it:

(1) to develop a draft national strategy for the management of recreational fishing in Australia,

(2) to summarise available data on the significance and extent of recreational fishing in Australia,

(3) to define the respective roles of the States, Territories and Commonwealth in the management of recreational fishing,

(4) to identify funding options for recreational fisheries management and examine the case for Commonwealth funding assistance for the States and Territories, and

(5) to report on information needs and survey options for recreational fishing.

While the vast bulk of recreational fishing takes place in State jurisdictions, it is still important in a number of Commonwealth controlled fisheries. These include Southern Bluefin Tuna and East Coast Tuna and the South East Trawl fisheries. Recreational fishing is a major activity in the Great Barrier Reef and is popular in the rivers of Kakadu National Park, both areas under Commonwealth control.

Recreational fishing is one of the most popular outdoor activities in Australia. It has been estimated that approximately 4.5 million Australians undertake at least one recreational fishing trip per year (PA Management Consultants 1984, cited in Recreational Fishing Advisory Committee 1990). Far fewer are considered to be dedicated, regular fishermen. The Australian Recreational and Sport Fishing Confederation stated that there are approximately 810ÿ000 people in this category.

Recreational fishing is claimed to be a major attraction for a considerable number of overseas visitors to Australia. Research by the Bureau of Tourism Research suggests that about 100ÿ000 international visitors have fishing as one of their motives for visiting Australia. The data do not show how many come primarily to fish.

A very wide range of fishing modes are encompassed under the general activity of recreational fishing; for example, beach/headland/pier fishing, fishing in inland streams and water storages, fishing from private boats and fishing from hire/charter/game boats. Because only fishing in Commonwealth waters is of direct interest in this inquiry, not all these types of fishing activity are relevant. Data are not available on an Australia-wide basis to indicate the number of fishermen undertaking activities in Commonwealth waters. While there is an estimate provided by the Australian Recreational and Sport Fishing Confederation, that 17 per cent of domestic fishermen fish in the `open sea' (that is, 765 000 persons), this number cannot be taken as representing the numbers fishing in Commonwealth waters.

About 210 000 fishermen belong to clubs. This includes the clubs affiliated to Australian National Sportsfishing Association which have a membership of about 100 000.

**Research**

There has only been a limited research into recreational fishing in Commonwealth fisheries. The Australian Institute of Marine Science (AIMS) has collected data on the length, weight and sex of all billfish caught in Queensland tournaments since the 1980s, and the New South Wales State Government has maintained data from tournaments in that State.

The BRR undertook a two-year research project into yellowfin tuna in 1986Ä87 and 1987-88. More recently, it has co-ordinated a project looking at means of collecting data on recreational billfishing and made recommendations as to how this could be undertaken. It also commissioned a study by Kewagama Research of charter boat operations.

Unlike its predecessor, FIRDC, the Fisheries Research and Development Corporation (FRDC) will have the power to assign funding to research into recreational fishing. At the moment a priority area for research is the impact and extent of recreational fishing in the SET fishery given the need to determine the total allowable catch for fish that are going to be subject to individually transferable quotas. Presently there is very little information on the recreational catch of these fish.

## 3.5 Assessment of the current institutional framework

Section 3.2 painted a picture of the Australian fisheries management framework as a group of separate organisations whose formal and informal interrelationships form a web which makes unified and rational decision-making extremely difficult. Even if limited to the somewhat narrow function of managing only commercial fishing, there are problems associated with the framework. If the considerably broader range of functions necessary for resource management in the AFZ are to be addressed, as they should be, the framework is even less appropriate. This framework is not a consequence of a deliberate attempt to devise a system most suitable for the management of the AFZ but has evolved over time. Evolution may be capable of making the small changes necessary to adapt to minor changes in the institutional environment, but significant changes require new approaches.

CSIRO Division of Fisheries submitted that they believe that this is what is wrong with the pre-AFMA institutional framework and the present framework under AFMA:

> Current structural arrangements derive from pre-existing structures which were set up to facilitate co-ordination of fisheries management and research at a time before the Offshore Constitutional Settlement. Grafted onto this has been a structure which has been set up in an ad-hoc manner to provide advice to the managers of Commonwealth managed fisheries. The proposed new directions in management have not yet clearly identified the sources of advice to management ....

Talented people can sometimes work wonders despite an inappropriate institutional framework. Nevertheless, it is clear that every attempt must be made to adopt the most appropriate arrangements for both resource and fishing industry management, to increase the likelihood that successful management will eventuate.

The formation of AFMA has resulted in some important changes to the institutional framework. These include the explicit requirement for fisheries management to be consistent with the principles of ecologically sustainable development and the recognition of recreational fishing as a Commonwealth responsibility in Commonwealth-managed fisheries. Nevertheless, the following comments which describe the pre-AFMA situation illustrate problems in terms of a lack of a comprehensive, integrated approach to management, which the new institutional arrangements do not address.

While responsibility for management of commercial fisheries lies with AFS, responsibility for resource management is much more diffuse. This fact is illustrated in Figure 3.1 by the large number of separate organisations involved in resource management either directly or indirectly. Therefore, if there is to be sound decision making the lines of communication must be open, the distinction of roles between these organisations must be clearly defined, and one organisation must be entrusted with the responsibility of co-ordinating management. This responsibility is taken at the political level through the AFC ministerial meetings and through the associated Standing Committee on Fisheries. AFS stated that it looks to the AFC and Standing Committee on Fisheries for policy direction in the management of the marine resource. With the exception of the East

Coast Tuna Management Advisory Committee (ECTUNAMAC) which provides observer status to a representative of recreational fishing, none of these bodies include representation of non-commercial fishing uses of the living marine environment. The bodies with direct responsibility for management do not have any direct influence on research, which is a basic requirement to do such essential things as establishing TACs. The fact that an OCS agreement has not been reached between the Commonwealth and New South Wales and the continuing conflicts between Southern Shark fishermen from the various States indicates the political difficulties involved where an integrated fisheries science approach is lacking.

Resource management requires an institutional framework which encourages a synthesis of the ecological, biological, economic, and public policy disciplines. At the Commonwealth level, this synthesis requires the co-ordination of a number of organisations, some of whom do not have resource management as a significant function, but nevertheless have an influence, in some cases a significant one. Other organisations, whose brief is the management of the resource, are pressured to place an emphasis on industry management. Both the framework which presently exists and that which will come into being with AFMA creates a substantial middle ground. Some States have taken a different approach to that of the Commonwealth in that they have an 'integrated' approach to fisheries management.

The chance that the above criterion will be met is decreased by the existence of conflicting objectives between not only the organisations involved, but also the different users of the resource.

Conflicting objectives are evident between recreational and commercial fishermen. They may also exist between commercial fishermen, endeavouring to attain maximum short term returns from a fishery, and those who wish the fish stock to be utilized on a long term sustainable basis. Commercial fishermen may also have disputes with Government over the proportion of the TAC allocated to foreign fishing nations. Conflicts in objectives may exist between the various bodies involved in management related activities. This problem is exacerbated at the Commonwealth level by jurisdictional issues with the States and by divisions of responsibility within the Commonwealth itself.

Further possibility for conflict between commercial fishermen and Government exists over the implementation of unpopular regulatory mechanisms, or over the allocation of fishing rights. Disagreements over the different conditions on licences and whether or not these conditions are being complied with can also be points of contention.

In contrast to the Commonwealth most of the States have all of the arms of fisheries management under the same umbrella organisation. Research, the resolution of conflict among competing uses of the resource, development of controls on catching, and fisheries policy are all done under the one organisation in most of the States. Nevertheless, the fact that not all States have followed this formula, and that 'integrated' management means somewhat different things to different fisheries managers, suggests that no one model has gained universal acceptance. That stated, views are changing, particularly with regard to placing fisheries management within the much broader context of resource management. This comprehensive approach necessitates an institutional framework which is deliberately designed for the task.

Resource management of the whole AFZ is the highest order function of fisheries management. It is the responsibility of both the Commonwealth Government and the State/Territory Governments.

The two levels of Government have to be involved - and in a co-ordinated fashion - because of the existing jurisdictional separation of areas of the AFZ. The need for co-ordination cannot be over-emphasised. It is a recognition of the ecological relationships in the marine environment which do not recognise political boundaries, and it is a recognition of the fact that what is allowed in the way of fishing or other uses in one part of the ecosystem impacts both biologically and economically on related parts. Given that what happens in the coastal zone terrestrial environment can have impacts on fishery productivity (and other values of the marine environment) and that approval for land use is often the responsibility of local Government, that level of Government has a role to play in the necessary co-ordinated approach.

Responsibility for resource management presently is spread over a number of agencies of Government on both a geographical and functional basis. The new Commonwealth fisheries management agency, AFMA, will have a direct responsibility for *fisheries* matters in *managed* fisheries. In a functional sense it has resource management responsibilities, as described above, in developing Plans of Management. In a geographical sense its responsibilities cover only certain areas of the AFZ. Other Commonwealth agencies, such as the Great Barrier Reef Marine Authority and the Australian National Parks & Wildlife Service, have resource management responsibilities for parts of the AFZ or particular species such as whales and dugong.

Responsibility for AFZ resource management cannot be divorced from the role of research institutions, particularly CSIRO, BRR, ABARE and similar bodies at State level. Such bodies do not have direct management functions but rather advisory ones in terms of recommending levels and types of use.

The area of the AFZ is approximately equal to the area of mainland Australia. While its fishery production is limited, it is nevertheless an important export earner and source of high quality seafood for domestic consumption. Its waters are part of the migratory path for a number of valuable tuna species. It also encompasses the most extensive and well protected coral reef ecosystem in the world. These, plus other values, point to the importance of co-ordinated resource management for the whole zone. An institutional framework needs to be put into place to achieve this objective. This is a concept that was supported by many participants in the Inquiry.

The second order level of management is undertaken by fisheries agencies such as AFMA. This is also the case with other agencies of government having specific functions in the AFZ. This overlap

means that clear institutional links have to be established between AFMA and those responsible for the development and implementation of a national policy. The major focus and work of AFMA will be the formulation of Plans of Management for Commonwealth fisheries and overseeing the implementation of such plans through the day-to-day functions of administration, monitoring, surveillance and enforcement. A prerequisite for the development of such plans and subsequent monitoring is significant input from scientific bodies, such as CSIRO, BRR and ABARE. This is necessary because there is not a formal integrated approach to fisheries management at Commonwealth level - in terms of integrating the scientific input with the management functions.

In undertaking its functions of plan development and day-to-day management, AFMA can if it wishes - in fact, the expectation is that it will - rely on the advice of management advisory committees (MACs) established for specific fisheries. A Plan of Management can make provision for the performance of functions or the exercise of powers by a MAC, which would be established under that Plan. Obviously the precise role of MACs will not be known until they come into existence and it could be expected that their roles could differ from fishery to fishery and evolve over time. For example, in long-established fisheries with a past history of MAC involvement it is feasible that it will be capable of undertaking a number of activities which can be defined as fishery-specific collective action. A possible model is the Spencer Gulf and West Coast Prawn Fishermen's Association Inc. which undertakes industry management activities of a collective kind. In fisheries containing a number of sub-fisheries (such as the South East Trawl fishery) or where there is a significant recreational fishery (such as East-Coast Tuna) the devolution of powers to MACs will involve greater complexities.

The past Director of the Western Australian Department of Fisheries in his submission to this inquiry stressed the importance of resource management and stated that the most effective and efficient way of involving all the disciplines necessary for resource management is by having all the groups working under the same roof with the same objective.

He has also stated emphatically that the responsibility for the management of the resource is a government responsibility (Bowen 1988):

> ... government should not consider passing to one user group the prime responsibility for management advice.
>
> In the broader context, as the effect of fisheries management initiatives in one fishery flow into other managed fisheries, government must still maintain the wider responsibility of management in order to address issues arising from gear conflict and wider planning requirements.

The requirement for government to undertake resource management is not inconsistent with the concept that fishermen should be involved in, and in fact responsible for, matters that are best left to the fishing industry itself The crucial issue is to delineate resource management and industry management. As discussed previously, this is by no means straightforward, particularly in input controlled fisheries because the controls often have the dual function of enhancing the financial performance of fishermen and protecting the stock. Even in ITQ managed fisheries there can be biological controls which have this dual function. A practical example of the separation of resource management and fishing industry management is the South Australian Spencer Gulf prawn fishery.

How well does the current institutional framework serve the demands of effective industry management? There is little doubt that the location of all fisheries managers in Canberra with no representation in proximity to the fisheries is a handicap, especially for fishing industry management. High travel costs both in terms of time and money mean that those involved in fisheries management 'get their feet wet' very rarely. While AFS staff travel to meetings they do not have close involvement with the every-day workings of each fishery. It is difficult for them to be responsive to problems in either resource or industry management. Communication between fishermen and other government agencies is generally more remote. Few Commonwealth fisheries have the close contact enjoyed between the Northern Prawn fishery and staff of the CSIRO, Cleveland Laboratory.

In light of this it is not surprising that the Tasmanian Fishing Industry Council submitted:

> .... [the Commonwealth] should operate a streamlined, centralised and efficient Canberra bureau managing licensing and collection of licence revenue. Everything else should be decentralised in the interests of efficiency .... Physical management should be contracted to State Management Authorities or private contractors to maximise cost effectiveness. An autocratic Canberra based fish bureaucracy is neither desirable, affordable, nor necessary.

According to AFS, it has recently worked towards a closer association and interaction with industry in formulating management decisions. An example of this closer relationship was recent negotiations with industry in achieving a substantial reduction in the TAC for orange roughy in the South East Trawl.

If one accepts the multi-faceted and integrated management approach required for modern fisheries management, the current institutional framework of Commonwealth fisheries management does not encourage development of expertise in the area. There is a need to build up and retain a certain critical mass of professionals in the central management agency, AFS/AFMA.

# 4 CURRENT FUNDING ARRANGEMENTS

Funding arrangements vary between the various organisations involved in management of Commonwealth controlled fisheries. At present the main ones are the Australian Fisheries Service (AFS), and the fisheries sections of the following research organisations: CSIRO, BRR and ABARE. Each of the research organisations receives its funding both through direct Commonwealth appropriations and the AFS budget, in particular through FIRDC funds which are included in the latter. State organisations also perform various management and research functions for the Commonwealth, but for the most part these are funded through the FIRDC or other parts of AFS budget.

While the funding arrangements for AFMA, the successor to AFS, are still to be determined, the Government's decision to freeze funds at current levels for two years and the limited access to research funding is discussed. So also are the funding arrangements for FRDC, the successor to FIRDC.

## 4.1 The costs of Commonwealth fisheries management

On the basis of the information available to the Commission, Government spending on Commonwealth fisheries management in 1990Ä91 was of the order of $28 million. About $27 million was spent on resource management and at least $1 million on industry management.

Spending on on resource management can be broken down approximately as follows: $4 million on `role of government' activities, $15 million on research, $2 million on the surveillance of domestic and licenced foreign fishing, $0.75 million on logbooks and about $6 million on other costs such as fisheries administration. Included in the cost of resource management is $3.7 million spent specifically on the management of licenced foreign fishing.

Through various levies and licences, domestic fishermen contributed $5.7 million towards management costs while foreign fishermen contributed $3.7 million (See Table 4.1.). The latter also paid $4.4 million in access fees.

The $4 million spent by AFS on the 'role of government' aspects of fisheries management included the following. About $1.6 million was spent on the activities that under AFMA will remain with the DPIE policy cell. This involves such matters as advising the Minister and undertaking government to government relations on fishery matters. About $1 million was spent on foreign fishing vessel apprehension and $1.1 million for reimbursements to the States for State fishery officials involved in AFZ surveillance through the Coastwatch program. This surveillance aims to detect illegal foreign fishing. The bulk of surveillance undertaken through Coastwatch is multi-purpose, serving the needs of a range of users. These include the Department of Immigratation, Local Government and Enthic Affairs (DILGEA), The Australian Customs Service, the Australian Federal Police, the ANPWS, AQIS and GBRMPA. In 1990-91 Coastwatch spent $16.6 million.

The estimate of $15 million on research spending for Commonwealth resource management is an approximation. A more accurate figure is not possible because of the different accounting methods employed by research organisations and the fact that available information on research funding is not disaggregated in a way that would allow ready calculation of what is spent on Commonwealth resource management as opposed to industry management, State fishery resource management or the marine environment as a whole.

Spending on resource management related research for Commonwealth controlled fisheries has a number of sources. FIRDC supplied about $3 million. A further $2.5 million came through funds managed by AFS. This included funds raised through levies on the industry and special allocations such as the Southern Bluefin Tuna Environmental Research Grant. The fisheries areas of CSIRO, BRR and ABARE all received some of their funding from the above sources. They also received their own direct Commonwealth appropriations. For CSIRO this direct appropriation, directed at research relevant to Commonwealth resource management, would appear to have been about $4 million. For the BRR it was about $0.9 million and for ABARE about $0.5 million.

The cost of surveillance of domestic fishing was $1.7 million while that for licenced foreign fishing was $0.3 million. The combined cost of all the logbook programs was $0.75 million. The breakdown by fishery is shown in Table 4.2.

The $6 million estimate for other costs includes the $1.05 million for administration that AFS considered to be attributable to specific managed fisheries, the non-specific general levy base for 1990-91 of $3.9 million and fishery specific resource management costs that are not cost recovered such as management policy development.

The $3.7 million spent on the management of licenced foreign fishing included $0.3 million on surveillance, $1 million on apprehension and $1.6 million on the observer program.

FIRDC, ABARE and AFS combined would have spent at least $1 million on industry management. Possibly half the $1 million allocated by FIRDC to research projects on such matters as post harvest technology and marketing would have related to Commonwealth fisheries. Studies undertaken by ABARE on industry issues such as the market for particular fish and the economic condition of fisheries would have cost about $0.5 million. AFS would have spent at least $100 000 in 1990-91 on developing and implementing the adjustment scheme for the Northern Prawn fishery.

It is interesting to compare Commonwealth figures with those for State fisheries although the costs incurred are different, as State fisheries management involves significant expenditures on recreational fishing and in some cases marine conservation. The South Australian Department of Fisheries had a total expenditure of about $8 million in 1990-91 for the management of fisheries with a commercial catch valued at $94 million. Spending included $3.4 million for research. The Department received $2.4 million for fishing licences, fees and registrations.

In the case of the Western Australian fisheries, with a landed value of about $366 million, expenditure by the Fisheries Department in 1990-91 was $13.7 million. Of this expenditure 27 per cent was spent on reseach, 6 per cent on management policy, 37 per cent on operations including surveillance and 30 per cent on corporate services. This includes $0.9 million on activities undertaken for the Commonwealth and for which the State was reimbursed. Revenue from access fees and licences was about $3 million.

In both of these States the revenue collected was far les than expenditure - approximately 34 per cent in South Australia and 22 per cent in Western Australia. Both States spent between 5 and 6 per cent of the landed value of the catch on management, but received only 1.2 per cent in WA and 2.9 per cent in SA of the value from industry. It should be noted that these Governments see surveillance and enforcement as normal functions of government rather than as an activity specifically attributable to fisheries management. In both States revenue is collected from fishermen through levies set as a percentage of the gross value of production. This proportion varies by fishery. In some fisheries the levy is in excess of management costs and a management rent is collected.

## 4.2 AFS funding

From the early 1980s the Commonwealth adopted the policy that some of the costs of management should be met by those who benefit from management, and began to apply this to the fishing industry.

General policy guidelines exist to classify management expenditure into recoverable and non-recoverable cost components. Within these broad guidelines AFS fisheries managers have broad discretion to assign costs to either category.

Recoverable costs are classified into fishery specific and non fishery specific. The first are 90 per cent cost recovered by the fishery management levy. The second are contributed to by the non-specific fisheries management levy paid by holders of Commonwealth Fishing Boat Licences (CFBLs). Non-recoverable costs are met from Commonwealth appropriation.

The policy of charging 90 per cent of fishery specific recoverable costs has its origin in the recommendations of the 1986 BAE study. This policy was phased in, with fishermen contributing 60 per cent of the designated costs in 1987-88, 75 per cent in 1988-89, and 90 per cent in 1989-90. The CFBL levy which contributes to recoverable costs that are non-attributable to particular fisheries was set at $295 per CFBL in 1987-88 and raised to $395 in 1988-89.

The amount of any levy is set in regulations and the levy is payable at the time of a licence renewal, endorsement, variation, or on the allocation or renewal of units of fishing capacity under a management plan. These levies can include not only management cost recovery, but also research levies and industry adjustment levies.

Non-recoverable costs may or may not be fishery-specific. DPIE has submitted that fishery-specific non-recoverable costs can occur in the following way:

> If a fisheries manager identifies a specific fishery cost as relating to core functions of government and thus non-recoverable in terms of the policy guidelines, it does not get built in to any levy base. This reflects the blend of policy formulation and operational activities existing in particular fisheries.
>
> Those parts of AFS considerd to be non-recoverable include: the Review and Evaluation Team; the Sustainability Task Force; and any Policy Project Unit officers from time to time placed in AFS.

There are other sections of AFS which have functions that are generally considerd non-recoverable, although from time to time, they do work related to fisheries management. They are the Policy Development and Co-ordination Section; the Projects Section; and the International Section.

Parts of AFS, other than the various Fisheries Sections, have some functions which are considered cost-recoverable and others which are not. These sections are: the Legal Section; the Licensing and Surveillance Section; the Communication Section; the Planning and Services Section; and the Information and Management Section.

The Communication Section does not cost recover for its services to individual fisheries. However, if specific tasks are undertaken for a specific fishery, then costs would be recovered as part of the management levy to be paid into the AFS budget. The 'Australian Fisheries' magazine is distributed free of charge to CFBL holders and to fisheries researchers. FIRDC provides a grant to cover the costs of these free copies. Other subscribers make payments which cover the costs of the run-on copies. They do not contribute toward the preparation or printing set up costs of the magazine. Advertising provides the only other revenue source for the magazine.

AFS costs associated with surveillance and enforcement of illegal foreign fishermen are not recovered as 'defence of the realm' is the prime objective. In fisheries where foreign vessels are permitted to operate, surveillance and enforcement costs are recovered from foreign operators.

Recoverable expenditure by AFS in 1990-91 came to about $11.6 million, comprising $4.1 million for specific recoverable expenditure in managed fisheries, $3.9 million for non-specific recoverable costs and $3.7 from foreign fishermen.

Table 4.2 provides details of the recoverable management costs for all domestic fisheries managed under the 1952 Fisheries Act. In 1990-91, 60 per cent of AFS's revenue came from Commonwealth appropriations.

Not all fishermen in Commonwealth fisheries have paid management levies. There is no recovery of any management costs for holders of licences under the Continental Shelf Act. They do not pay the non-specific fisheries management levy of $395. There was no legislative provision under either the Fisheries Levy Act or the Continental Shelf Act for imposition of such a levy on domestic fishermen licenced under the latter Act. Under the new legislation this has changed. The same provisions as apply to all other Commonwealth managed fisheries will apply to continental shelf fisheries. Although there has been legislative provision since 1984 for the imposition of levies and licences in the Torres Strait this has not occurred.

There are a number of notice fisheries which are not yet cost recovered. In the case of the Bass Strait Scallop fishery a management plan is currently being developed for implementation if the stock recovers. Once this is in place, it is expected that a specific fishery management levy will be put in place. The three deepwater fisheries of Norfolk Island, East Coast Deepwater Crustacean Trawl and the East Coast Deepwater Finfish Trawl are all developmental fisheries with low expected prospectivity, and negligible levels of production at the moment. If preliminary research indicates they are viable fisheries, then management plans will be developed and levies would then become payable.

An overview of AFS's revenue and expenditure is presented in Tables 4.1 and 4.3. The aggregate break-down of those costs recovered from fisheries and other revenue sources including Commonwealth appropriations are presented in Table 4.1. In 1991-92 revenue from the non-specfic levy will be less than expected because of a greater than expected decline in the number of holders of Commonwealth fishing boat licences.

Not all of the research expenditure in Table 4.3 is attributable to Commonwealth fisheries resource management. As discussed later in this chapter only about $3 million of FIRDC's spending is on such research. The rest is directed at State fisheries, aquaculuture or activities that the Commission would describe as industry management such as post harvest technology and marketing.

Table 4.1: **Australian Fisheries Service revenue [a] 1988-89 to 1990-91**

| *Revenue items* | *1988-89* | *1989-90* | *1990-91* |
|---|---|---|---|
| | $'000 | $'000 | $'000 |
| Australian Fisheries magazine advertising | 111 | 111 | 113 |
| Domestic licences | 499 | 288 | 469 |
| Domestic and foreign specific fishery management levies | 3026 | 5963 | 7 260 |
| CFBL Non-specific Fishery management levy | 1 570 | 1 277 | 1 417 |
| NPF voluntary adjustment levy | 3 945 | 4 011 | 871 |
| Other NFAP[b] payments on loan principal | N/A | N/A | 289 |
| NPF research levy | 575 | 226 | 99 |
| Orange roughy research levy | N/A | 143 | 125 |
| Commonwealth contribution | 13 665 | 15 853 | 18 700 |
| Total | 23 391 | 27 872 | 29 343 |

a) Adjustments have been made to some figures to reflect when payments were received, rather than when they were credited. All figures are net of refunds. It does not include trust account revenue from sale of assets, refund of project money or interest. b) National Fisheries Adjustment Program.
Source: DPIE

Table 4.2: **Fisheries management recoverable expenditure 1990-91**

| *Fishery* | *Administration* | *Surveillance & compliance* | *Monitoring & logbooks* | *Research* | *Secretariat* | *Total* |
|---|---|---|---|---|---|---|
| Great Australian Bight Trawl | 13 564 | 9 367 | 24 614 | 54 423 | | 101 968 |
| Northern Prawn | 363 684 | 439 235 | 221 047 | | 79 828 | 1 103 794 |
| Southern Bluefin Tuna | 130 678 | 292 895 | 56 000 | 479 573 | | |
| South East Trawl | 125 665 | 196 225 | 226 913 | 80 796 | 35 275 | 664 874 |
| Gemfish | 36 504 | 114 838 | | 43 750 | 195 092 | |
| South Western Sector Trawl | 30 837 | 258 028 | 49 946 | | | 338 811 |
| Southern Shark Gillnet | 105 975 | 233 277 | 55 162 | 109 885 | 3 074 | 507 373 |
| East Coast Tuna Longline | 122 304 | 76 610 | 96 178 | 78 760 | 850 | 374 702 |
| East Coast Tuna Purse Seine | 21 586 | 13 519 | 5 062 | | 150 | 40 316 |
| Kimberley Coast Prawn | 29 412 | 75 247 | | | | 104 659 |
| North West Slope Trawl | 13 328 | 1 230 | 34 691 | | | 49 249 |
| Northern Fish Trawl | 47 770 | | 16 000 | 10 000 | | 73 770 |
| West & North Western Deep Water Trawl | 8 343 | 770 | 21 717 | | | 30 830 |
| TOTAL | 1 049 649 | 1 711 241 | 751 330 | 433 614 | 119 177 | 4 065 011 |

a) These figures form the management cost levy base. b) Research figures do not include voluntary industry contributions of $99,028 for the Northern Prawn fishery and $124 722 for orange roughy.

Table 4.3: **Australian Fisheries Service appropriations for expenditure**

| *Expenditure items* | *1988/89* | *1989-90* | *1990-91* |
|---|---|---|---|
| | $'000 | | |
| **1. AFS running costs** | | | |
| (a) Salaries | 3 145 | 4 003 | 4 224 |
| (b) Reimbursements to States (other than 4(a)) | 4 624 | 4 373 | 5 397 |
| (c) Southern Bluefin Tuna Research (from PM's environment statement) | - | 637 | 912 |
| (d) Other administration | 1 852 | 4 737 | 4 445 |
| TOTAL RUNNING COSTS | 9 621 | 13 750 | 14 978 |
| **2. Fisheries Research** | | | |
| (a) FIRDC[a] | 7 880 | 7 880 | 9 290 |
| (b) FDTA | | | |
| (i) Commonwealth Sub-Acct | 300 | 150 | 150 |
| (ii) NPF Sub-Acct | 575 | 2 | 323 |
| (iii) OR Sub-Acct | N/A | 142 | 28 |
| (c) East Coast Tuna | 42 | 242 | 180 |
| (d) Tuna-Billfish Research | N/A | N/A | 91 |
| (e) Torres Strait Research | 602 | 412 | 647 |
| TOTAL FISHERIES RESEARCH | 9 399 | 8 828 | 10 709 |
| **3. National Fisheries Adjustment Program (NFAP) (including NPFVAS)** | 3 945 | 4 208 | 1 494 |
| **4. Other Payments** | | | |
| (a) Foreign Fishing Vessel Apprehension-State Reimbursements | 386 | 750 | 818 |
| (b) Torres Strait Capital Items | 40 | 336 | 960 |
| **TOTAL EXPENDITURE** | 23 391 | 27 872 | 27 960 |

a) FIRDC funding is discussed in detail later.
*Source:* DPIE

The reimbursement of monies to the States and the Northern Territory for surveillance and the observer program on foreign fishing vessels is shown in Table 4.4.

Table 4.4: **States reimbursement budgets 1990-91**

| *State* | *Surveillance*[a] | *Observers* | *Totals* |
|---|---|---|---|
| | | $'000 | |
| **New South Wales** | | | |
| Fisheries | 258 378 | - | 258 378 |
| **Victoria** | | | |
| Fisheries | 142 143 | - | 142 143 |
| **Queensland** | | | |
| QBFPb | 357 225 | - | 357 225 |
| QDPI | | 220 000 | 200 000 |
| **Western Australia** | | | |
| Fisheries | 668 057 | 64 524 | 732 581 |
| **South Australia** | | | |
| Fisheries | 369 044 | - | 369 044 |
| **Tasmania** | | | |
| Fisheries | - | 227 773 | 227 773 |
| Police | 415 327 | 137 031 | 552 358 |
| **Northern Territory** | | | |
| Fisheries | 281 894 | 400 000 | 681 894 |
| Police | 172 069 | - | 172 069 |
| **TOTALS** | **2 664 137** | **1 049 328** | **3 713 465** |

a) These figures do not include foreign fishing vessel apprehensions and assume that some salary costs will be attributed to the apprehensions appropriation. No logbook or research costs are included. There will also be additional expenses related to domestic prosecutions and extra patrolling as approved by Managers. b) This figure does not include the Torres Strait Cost Sharing Agreement.
Source: DPIE

**Fines and vessel forfeiture**

Foreign and domestic fines and forfeitures are coded together, so it is not possible to separate the income from domestic and foreign sources. Vessels are not forfeited in domestic breaches, though catch and gear can be. Income from such sales is not separated by domestic and foreign sources. In 1990-91 the disposal of forfeited foreign fishing vessels brought in $7.3 million.

**Foreign fishing and cost recovery**

Foreign fishermen pay access fees which comprise two distinct components:

- a component relating to the return to Australia derived from permitting foreign access to specific Australian fishery resources. The access fee may be set in advance for a particular fishery or may be subject to a negotiated or competitive bidding process.

- a component relating to costs incurred by the Commonwealth as a result of administration and monitoring foreign fishing activity (eg observer placement, logbook and radio reporting requirements, licensing etc).

The recoverable cost component reflects the projected costs of administration, monitoring and enforcement incurred by the Commonwealth which are directly attributable to the foreign fishing activity. In general, it is not open to negotiation. Only in very exceptional circumstances may all or part of the recoverable cost component be waived.

The access fee component may be negotiable, and may in some circumstances be partially or completely waived in recognition of significant benefits being provided to Australia from the foreign fishing operation.

In 1990-91 foreign fishermen paid $3.7 million in management cost fees and $4.4 million in access fees. The figures for Japanese fishermen were $3.0 million and $4.0 million respectively.

Collaborative fishing is the use of foreign fishing vessels in which an Australian principal has a commercial interest. The Foreign Fishing Boats Levy Act 1981 and associated regulations establish the legislative basis under which access fees are payable under collaborative ventures involving the use of foreign fishing vessels.

The extent to which the access fee component may be waived is determined prior to establishment of an agreement and in a manner similar to that which would have been applied had the venture been a wholly foreign fishing activity.

**AFMA funding**

While the method of funding AFMA is yet to be determined and is being considered by this inquiry, some decisions have been made that impact on this issue.

The Minster for Primary Industry and Energy has promised that industry contributions in aggregate to AFMA costs will not be greater in real terms for the duration of 1991-92 than for 1990-91 and that AFMA expenditure for fisheries management overall in 1992-93 and 1993-94 will not be greater in real terms than like expenditures in 1990-91, excepting voluntary levies and other costs set by industry (see Appendix A). In other words there is a freeze not only on what industry contributes but also on Government funding.

The imposition of such an expenditure ceiling is a matter of concern to the Commission given its potential to prevent AFMA from adequately performing its responsibilities. One would expect that some costs may need to increase significantly in the short term given the serious problems in a number of fisheries, which can only be addressed by a far better understanding of stock dynamics, and the need for a major overhaul of management arrangements. The establishment of ITQ's in the South East Trawl fishery would be a case in point. If the errors of the past are not to be repeated, considerable expenditure on research is going to be required to set TACs with a reasonable degree of confidence.

A draft budget has been drawn up for AFMA which essentially mirrors existing activities within AFS. The proposed 1991-92 budget is merely the proposed budget for AFS less the funding for the policy cell that remains with DPIE. The split up is $20.5 million for the former and $1.7 million for the latter. This means that at least in the immediate term the research funds at AFMA's direct disposal will be as limited as they were for AFS. They may in fact be made worse if the imposition of FRDC research levy on Commonwealth fishermen means that they will be less willing to continue with the voluntary levies that are currently collected by AFS.

This may be ameliorated to some extent by AMFA having some access to a research fund dispensed through DPIE which will be equal to 0.25 per cent of GVP. In part this fund is to contribute to public scrutiny research by the two bureaus within DPIE, BRR and ABARE. The proportionate share between AFMA, BRR and ABARE has yet to be determined.

An issue discussed throughout this report is the role - and the cost - of research in fisheries management. Without more research, and the integration of research and management, the severe existing problems are not likely to be resolved.

## 4.3 Assessment of AFS's cost recovery arrangements

Many participants criticised the cost recovery program, saying that they wanted management, were prepared to pay for management, but were not getting management. They complained about inefficiency in the provision of services such as logbook processing, high costs and over-servicing. They said that although they had to pay for the services, they had little say over the way they were provided. Some suggested that the MACs were deliberately set up and serviced so as to make them ineffectual as management bodies so that they would provide no effective check on AFS activities. Cost recovery has resulted in fishermen feeling aggrieved and soured relations with AFS.

Industry has also objected to having to cover Public Service salaries and conditions, reflected in what they considered to be high labour on-costs and overheads. The combined submission from the Northern Fishing Companies Association LTD, the Northern Prawn Fishery (QLD) Trawl Association, the Northern Territory Trawler Owners Association, and the Western Australian Northern Trawler Owners Association stated that:

> .... industry has little say over what the Government charges for its services. These are based on actual costs with a 32% on-charge for the salary component to cover superannuation, holiday, sick and long service leave and other conditions of service. Industry has no control over staff numbers, and other Government expenditure associated with management.

Some participants said that they could arrange to have services like surveillance and logbook collection and processing provided independently at lower cost. The Northern Prawn submission made the following suggestion in respect of minimising the cost of surveillance:

> Under current arrangements surveillance is undertaken by the Queensland Boating and Fisheries Patrol and the Northern Territory Police on behalf of the Commonwealth. Now there are no restrictions on State authorities crossing borders in the NPF there is no reason why one agency should not undertake surveillance on a contract basis or that private surveillance operators be asked to tender for the service as is done by Coastwatch. Similarly private contractors could be engaged to operate the logbook program which currently is the responsibility of the AFS.

If such activities as logbook collection and analysis are considered to be services to industry, rather than integral parts of a management function (which has the dual aims of facilitating economic efficiency and resource protection), AFS is comparable to a monopolist in the sense that it determines the cost that industry has to pay. Industry tends to view the management agency in this light. On the other hand, fisheries management authorities understand their functions to be far wider than this. This causes some of the tension and criticisms discussed above.

Of its own volition and as a consequence of increased industry involvement in the MACs, various measure have been taken by AFS to improve cost effectiveness. This has included contracting out certain functions.

While increased industry scrutiny may lead managers to be more cost effective in performing a certain function and to review the appropriateness of certain management measures it may also lead to cuts in programs in ways that prejudice effective resource management and indirectly have an adverse effect on long term industry profitability. There are a number of ways by which this could occur. An example would be inadequate funding of monitoring of catches leading to catches exceeding TACs. Another would be insufficient funding of research which could result in setting unsustainable TACs or fishing in breeding or nursery grounds.

There has been a deal of confusion over the cost recovery principles enunciated by AFS. The first DPIE submission to the inquiry defines recoverable costs as:

> those [costs] which would not have been incurred by the Commonwealth other than for the fact that there is a managed fishery from which fishers may derive a benefit.

Even where a cost is incurred only because there is a commercial fishery, it is not recoverable if it is deemed to be a core function of government. As well as the more obvious core functions such as relations with State or foreign governments or enforcement of regulations, the AFS also includes policy development and support (p. 13):

> ... in the case of fishery-specific policy development, industry already contributed significantly through its own deliberations, preparation of papers and attendance at meetings. Policy development was more generally a core function of government, as was the support item.

Included in policy development is the development or fullscale revision of management plans. Importantly, the development of restructuring programmes has not been cost recovered. The main case of restructuring to date has been the compulsory buy-back scheme in the Northern Prawn fishery. This buy-back is subsidised.

The AFS budget reveals that there is no consistent policy on cost recovery for research. While most research, such as that through FIRDC or undertaken by CSIRO, is not cost recovered, a certain number of programs are. They are cost recovered by AFS either through the management levy or a specific levy. These programs are discussed below in the section on research funding.

## 4.4 Research funding

The main organisations undertaking research on Commonwealth controlled fisheries are CSIRO, BRR, ABARE, and various State bodies such as the Marine Science Laboratory in Victoria and the Fisheries Research Institute. The main sources of funds for these bodies are direct Commonwealth appropriations, FIRDC and various funds administered by AFS. The State organisations are almost entirely funded through the latter two sources and are not discussed further.

### Fishing Industry Research and Development Council

FIRDC was totally funded by the Commonwealth up to a maximum level of one per cent of annual average national GVP, recorded over the preceding three financial years. The exact level of funding has been determined by the level of fisheries research funding in the States, which the

Commonwealth matched on a dollar for dollar basis up to the maximum. State research is often funded through industry levies. FIRDC funds were allocated through the AFS budget. The FIRDC is being replaced by the FRDC which is discussed later in the chapter.

In 1990-91 FIRDC allocated $7.2 million to various research projects (See Table 4.5.). About $1 million is for what the Commission would describe as industry management activities, such as post harvest technology, economic assessment and consumption surveys. $1.2 million was spent on aquaculture. Between $4 to 5 million was spent on research related to resource management. This includes research on resource assessment, environmental changes and fish disease. While the exact breakdown is not known it is thought that at least half of this goes to work related to Commonwealth fisheries.

FIRDC had three ways of granting funds. Firstly there was an annual call for applications from research bodies. The choice of projects was guided by a set of research priorities and funding was for variable costs only. Secondly there were requests to research bodies to put up proposals on certain areas of concern. Funding in these cases covered a wider range of costs than projects funded under the first arrrangement. Thirdly, there were the 'proactive' projects where FIRDC specified exactly what they wanted done. These projects were put out to tender and the Council paid the full cost.

Concerns about ensuring that research spending is guided by the strategic requirements of resource management are discussed in Chapter 5.

**Various research programs funded through the AFS budget**

As well as the money for FIRDC, a range of other research programs have also been funded through the AFS budget. In 1990-91 about $2.5 million was allocated through the following means.

These were the:

- research cost-recovered through the management levy;
- programs under the Fisheries Development Trust Account (FDTA);
- Torres Strait research and monitoring program;

- southern bluefin tuna environment grants;
- tuna and billfish research arrangements

Table 4.5: **FIRDC: Allocation of research funds, 1990-91**

| *Priority area* | *Number of projects* | *$ '000* | *%* |
|---|---|---|---|
| Fish resource assessment | 28 | 3 304 | 50.2 |
| Advancement of fisheries science | 6 | 558 | 8.5 |
| Environmental changes | 3 | 167 | 2.5 |
| Aquaculture | 17 | 1 241 | 18.9 |
| Fish disease | 7 | 246 | 3.7 |
| Post harvest technology | 2 | 112 | 1.7 |
| Economic assessment | 3 | 208 | 43.2 |
| Marketing | 2 | 120 | 1.8 |
| Dissemination of information | 9 | 620 | 9.4 |
| Sub-total | 77 | 6 578 | 100 |
| *Proactives:* | | | |
| National seafood consumption survey | | 550 | |
| Fisheries statistics | | 80 | |
| Sub-total proactives | | 630 | |
| TOTAL | | 7 208 | |

Source: FIRDC, *Annual Report 1989-90.*

In seven out of the eight fisheries where costs are recovered from the fishing industry, there is a research component in the management levy. There was a total of $433 614 in recoverable research of this kind in 1990Ä91. The amount for each fishery is shown in Table 4.2.

FDTA has had three sub-accounts: the Commonwealth, the NPF and orange roughy sub-accounts. The latter two have been funded through a separate voluntary levy on fishermen. The levy, however, does not cover AFS management expenses incurred in allocating the funds. In 1990-91 the expenditure from the NPF sub-account was $99 028 and $124 722 from the orange roughy sub-account. Expenditure from the Commonwealth account was $150 000. FDTA will cease to exist when AFMA takes over fisheries management.

As part of the Prime Minister's Statement on the Environment of 20 July 1989, it was announced that the Government would allocate an additional $1.45 million over the next two years to supplement the existing Souther Bluefin Tuna Research Program. In 1990-91 $0.9 million was spent from this fund.

Under the tuna fishing access agreement with the Japanese Government, $320 000 was provided in 1990-91 for research into tuna and billfish. Of this sum $140 000 was provided to the East-Coast Tuna fishery to supplement the research mentioned above.

The Commonwealth and Queensland governments together provided approximately $1 million during 1990-91 for research and monitoring programs on the traditional and major commercial fisheries in the Torres Strait. None of this was cost-recovered.

**CSIRO funding**

The main source of research for Commonwealth controlled fisheries is the Fisheries Division of CSIRO. The Division's funding is obtained both internally from a share of CSIRO's Commonwealth appropriation and from external sources. In 1990-91 the Division spent about $17 million of which $6 million was externally funded. This external funding included $1.8 million from FIRDC and $0.5 million from the Torres Strait research program. The breakdown by program for 1989-90 is shown in Table 4.6.

Table 4.6: **CSIRO Division of Fisheries; notional costs by program, funding source, and research category: 1989-90**

| *Program* | *Funding* | | | | |
|---|---|---|---|---|---|
| | *Appropriation* | | *External* | | *Total* |
| | *$ '000* | *%* | *$ '000* | *%* | *$ '000* |
| Population Dynamics | 1 456 | 100 | 0 | 0 | 1 456 |
| Algae | 571 | 73 | 206 | 26 | 777 |
| Fisheries, S & SE | 1 529 | 46 | 1 784 | 46 | 3 313 |
| Fisheries, N & NE | 2 278 | 59 | 1 557 | 41 | 3 834 |
| Fisheries, W & NW | 799 | 58 | 569 | 58 | 1 368 |
| Biological oceanography | 1 000 | 89 | 121 | 10 | 1 121 |
| Applied environmental studies | 293 | 75 | 95 | 24 | 388 |
| TOTAL | 7 921 | 65 | 4 332 | 35 | 12 258 |

Source: F. R. Harden Jones (1989), 'On the balance between tactical and strategic research' (unpublished).

The Division currently devotes about two thirds of its resources to fisheries research. In 1990-91 that would have been about $11 million. The balance goes into aquaculture and environmental research. This relative share was one of the recommendations of a recent external review of the Division. Of this $11 million, the bulk is directed at Commonwealth fisheries. Very little is for State fisheries.

The level of Commonwealth appropriation going to the Division of Fisheries is determined internally by CSIRO. It therefore depends on the extent of overall funding for the organisation and the priority it gives to fisheries research.

At the Draft Report hearings, the Division of Fisheries expressed two concerns about future funding that could undermine the policy of directing two thirds of its funds to fisheries research.

The first concern related to the Commonwealth policy that CSIRO raise 30 per cent of its funding from external sources. In the case of the Fisheries Division this is achieved mainly through FIRDC funding. There was a fear that if FRDC funding were to be reduced or become less available to the Fisheries Division and this were to push the external funding below 30 per cent, there would be strong pressure to get back to 30 per cent by looking elsewhere. Given the limited alternative sources for fishery research funds, the fear was that this would lead to a greater emphasis on other aspects of the Division's work such as aquaculture and environmental research.

The other concern related to the fact that every year the Division has to give back to CSIRO 1.5 per cent of total funding. In the second year this means a 3 per cent reduction, in the third year 4.5 per cent and so on. That money is used for new initiatives by the CSIRO executive. The Fisheries Division can apply for funding from this but there are priorities and fisheries is not one of them.

The problem is compounded further by the fact that in order to get this money, the Division would have to put in matching resources. So, if the project is not fishery related there could be a doubling of the diversion from fishery research.

Under current arrangements the Division has to meet the full costs of managing *the FRV Southern Surveyor* from its own budget. In 1990-91 operating costs were $4.7 million. CSIRO would prefer that the vessel was operated as a National Facility and consequently be funded separately by the Commonwealth. A proposal to this effect is currently being assessed by the Australian Science and Technology Council (ASTEC).

The *RV Franklin* which has many common research features to *FRV Southern Surveyor* is already a National Facility. It is operated by the CSIRO Division of Oceanography but made available to the scientific community and separately funded. Access to the vessel is determined by a standing committee. While users are charged they are heavily subsidised by the Commonwealth. It has

been suggested that the two boats be managed jointly to rationalise their use since each is equipped to conduct various types of fisheries and oceanographic research. Cost effective use of the two vessels would also be facilitated by both being subject to similar funding arrangements. At the moment third parties that use the *Franklin* are subsidised while those that use *the Southern Surveyor* are not.

According to the Review of the CSIRO Division of Fisheries, the appropriateness of *making FRV Southern Surveyor* a National Facility depends on whether the Division needs to have greater access than would be available under such arrangements and whether there are institutions in Australia which could benefit from having access to the vessel under National Facility guidelines (ie, at direct project costs only). Some of the State fishery research agencies and universities have expressed an interest in doing so. The Review also expressed concern that the availability of the vessel may influence the research effort irrespective of whether it is the most effective use of people's time and the Division's resources.

**Bureau of Rural Resources**

Most of BRR's funds come from direct appropriation. Additional sources of funds include AFS, DPIE, FIRDC and FDTA. Table 4.7 provides a summary of the budget for fisheries activities.

Table 4.7: **BRR, Fisheries Resources Branch, 1990-91 budget summary**

| *Funding Source*[a] | *BRRAFS appropriation* | *DPIE* | *FIRDC (sp. fund)* | *FDTA* | *States* | *CLO*[b] | *Overseas* | *Total* |
|---|---|---|---|---|---|---|---|---|
| Amount | $784 345 | 115 285 | 120 000 | 267 946 | 16 760 | 59 135 | 5 200 | 1 368 671 |

a) BRR and AFS funding are allocated from the DPIE appropriation b) Chemical Liaison Officer (Fisheries Pollution Committee)
Source: BRR

**Australian Bureau of Agricultural and Resource Economics**

In 1990-91 ABARE expenditure on fisheries research amounted to approximately $1.055 million. Of this about 75 per cent was funded from direct appropriation while the remainder was funded through FIRDC and FDTA.

The research ranges across both resource and industry management, aquaculture and also projects that have a 'role of government' or public good characer.

About half the current projects in the Fisheries Economics Section have a research management character and include examining management options for the Southern Shark Fishery and Torres Strait prawn fishery, and the feasibility of ITQs in the Northern Prawn Fishery.

**Fisheries Research and Development Corporation**

As with FIRDC, its predecessor, FRDC will provide funds for research not only on Commonwealth controlled fisheries but also for State ones and aquaculture. Its funds will come from fishermen and from appropriations from the Commonwealth Government. The Commonwealth Government will automatically provide 0.5 percent of the average annual GVP for the preceding three years. The Commonwealth will provide up to a further 0.25 per cent if it is matched by Commonwealth and State fishermen. The contribution of this amount is dependent on participation by the States, as it is up to each State to determine if it wishes to levy its fishermen for this purpose. While considered remote, there is also the possibility that the States would choose to raise less than 0.25 per cent of their GVP. For 1991-92 it is doubtful that all States will participate, and therefore total FRDC revenue for this period will probably be less than the maximum of 1 percent of GVP. At this stage there is only a clear commitment from three States.

Funding for 1991-92 is through FIRDC's remaining reserves of $9 million. These will just suffice to cover administrative costs for that period and provide research funding of $7.3 million.

The target of 1 per cent of industry GVP is the same as that which applied to other primary industry R & D levy arrangements. It makes no allowance for the fact that fisheries research tends to be more expensive nor for the critical role of research in resource management. For many years research expenditure from all sources (in particular CSIRO) has accounted for over 5 per cent of GVP, most of it for resource management.

There are a number of aspects of FRDC arrangements that could lead to an inefficient allocation of research funds. Firstly, FRDC is being established under the *Primary Industries and Energy Research and Development Act 1989* which was developed for farm research and has an industry rather than resource management orientation. Secondly, a commitment has been made that over a number of years particular States and particular fisheries will get back at least what they have contributed. This has the potential to prevent research funding going to where it is most needed. For example, it is likely that of Commonwealth fisheries, most money would go to the Northern Prawn fishery, which has already had the benefit of many years of taxpayer funded research and does not now require the substantial research which is needed in the South East Trawl, Southern Shark and Southern Bluefin Tuna fisheries. For example, BRR estimates that $21.6 million will be needed over the next four years to set reasonably accurate TACs for the South East Trawl fishery. The levies paid by fishermen in that fishery would only be a very small proportion of that figure.

Even apart from these biases in FRDC funding policy there is the more general problem of ensuring that research funding for Commonwealth fisheries is directed to those areas where the manager, AFMA, places the greatest priority. Given the importance of FRDC funding, this will depend very much on the relations between the two bodies, including the presence or absence of AFMA representation on the FRDC board.

## 4.5 Cost recovery for recreational fishing

Except for the payment of the general user fee at Kakadu National Park by visitors who happen to fish, there is no cost recovery from recreational fishermen in Commonwealth controlled fisheries. In the State fisheries there is some cost recovery through recreational licences. Some States have licences for the more valuable species such as lobsters and abalone.

The Tasmanian Division of Sea Fisheries estimated that the cost of administering its amateur licencing system at $4.44 per licence. The total cost of the licence was $35. They have two licences, the amateur craypot and the amateur diving licence.

The Inland Fisheries Commission in Tasmania, which is responsible for the management of their recreational inland fisheries, collected $790 000 in angling licence fees from 36 000 recreational fishermen in 1990-91. Total receipts for 1990-91 were $1.4 million. Its total research expenditure for 1990-91 was $397 000 and six full time surveillance officers were employed.

In Victoria the State Government is considering proposals for the introduction of a licence fee for recreational fishermen, applicable in all waters. That State already has a $20 annual licence for fresh water and estuarine fishing.

New South Wales abolished its inland angling licence partly to ensure equity with marine recreational fishing which was not subject to licensing. However, the inland licence had provided funds for resource management which have not been fully replaced by appropriations.

The licensing of recreational fishermen is quite common overseas. In the United States, for example, licences are universal. They are issued by the states and sold through tackle shops. Out-of-state fishermen generally pay a higher fee. Licences can be for various durations and endorsed for specific sorts of fishing. Generally children do not need a licence and in many cases the elderly are also exempted. As well as being a method of cost recovery licences have also proved to be a source of information for managers (with regard to numbers fishing, species caught, etc.).

The Australian Recreational and Sport Fishing Confederation has recently expressed support for recreational fishermen contributing to fisheries management and research providing that they are given a say in fisheries management and providing that the Commonwealth contributes to recreational fisheries management and research in the same proportion that it contributes towards commercial fishing. At the same time the Confederation opposes any Commonwealth licence that was in addition to a State one, for example, where fishermen need to cross two jurisdictions.

At the Draft Report hearings, Tom Bergin of the Australian Recreational and Sport Fishing Confederation proposed that only the more serious anglers be licensed. In return they would receive larger catch limits and be entitled to fish for the less commonly caught species such as trout, crayfish and billfish. He said such a system would retain the citizen's 'right' to free access to the 'commons' and would impose the costs of management on those who make the greatest use of the resource.

**The hypothecation of indirect taxes**

Recreational fishing groups have argued that they contribute such a large amount to consolidated revenue through the payment of sales tax and import duty on fishing gear, and excise tax on fuel for boats, that they should not be asked to pay any additional amounts for fisheries management. The Commission estimates that in recent years $6.5 - $8.5 million was paid annually in wholesale sales tax on fishing gear.

The Australian Recreational and Sport Fishing Confederation said:

> Recreational fisheries management in the United States is funded primarily through levies on manufacture of recreational fishing tackle and fuel which are hypothecated towards the restoration of fisheries and matched dollar for dollar by state governments. In Australia, the Commonwealth Government totally rejects the concept of hypothecation, some would say this is because hypothecation imposes a level of accountability on Government to which it is unaccustomed.

The Sydney Metropolitan Division of the Fishing Clubs of Australia (NSW) submitted that (p. 1):

> We as Amateur Fishermen already pay import duty on all our tackle, petrol tax, including road tax on all our fuel, even though we make very little use of the road system.
>
> We pay a boat licence and boat registration as well as petrol tax, and our roads, which is the open sea, needs no maintenance so why should we have to pay a levy on every litre of fuel that we use?
>
> If the revenue from import duty, sales tax and petrol tax was channelled into the correct areas, rather than being channelled into consolidated revenue, perhaps there would be no need to consider a user pays principle with respect to the recreational fisherman.

The original intent of the indirect taxes in question is to raise general revenue and not to raise revenue for particular purposes involving the taxed commodities. Given this objective, there is no more case for earmarking

Box 4.1: **Hypothecation in the USA**

The Dingell-Johnson Act in the US provides aid to the States for the restoration and management of all species of fish that have value in connection with sport or recreation in US waters. The program is financed by the earmarking of those funds received from the 10 percent manufacturers' excise tax imposed on sales by manufacturers, producers and importers of a wide range of fishing equipment. The equipment covered in the scheme includes: rods, reels, spears, fishing tackle, fishing belts and harnesses, electric outboard motors and sonar fishfinders. The last two items are only subject to 3 per cent excise tax as they are not used solely for recreational and sport fishing.

In addition, excise tax raised from the sale of fuel for boats is hypothecated into the national boat safety program.

Under the Dingell-Johnson Act 40 per cent of the monies raised are allocated back to the States on the basis of geographical size, and the other 60 percent is allocated in proportion to the number of licenced recreational fishermen in the respective States.

revenue from the sale of a fishing rod than there is from the sale of a tennis raquet.

Recreational fishing organisations have argued that there is a bias towards commercial fishing caused by taxing the inputs into their fishing and not the inputs into the commercial sector's fishing. However, commercial fishermen's incentive to catch fish is reduced by having to pay income and capital gains taxes while recreational fishermen pay no comparable tax on the benefits they gain from fishing.

The Commonwealth Treasury has said that hypothecation of indirect taxes may be worth examining where:

- there is no more direct way of collecting revenue to cover the costs of an activity;
- there is a close relationship between the use of a taxed input and the application of the hypothecated funds; and

- the rate of the hypothecated tax can evolve to reflect and finance the demands of the relevant activity.

The Treasury expressed the belief that none of the above criteria are met in the case of recreational fishing.

A practical impediment to the hypothecation of indirect taxes in Australia is the nature of the existing structure for indirect taxation. Indirect taxes are paid at the wholesale level and many wholesalers deal in a wide range of goods. They are not required to give details of the break up within these broad categories, making it very difficult to identify the amounts involved for specific categories of goods. To rectify this would add to administration and compliance costs.

The Treasury summed up its view of the matter in the following way:

> ... the hypothecation ideas broached to the Industry Commission by recreational fishing associations are undesirable from a fiscal policy perspective, unworkable from an administrative perspective and, given the impracticality of allowing WST and excise tax to vary with fisheries management requirements, unlikely to produce any economic efficiency gains. Indeed, efficiency losses through irrational biases to expenditure seem more likely.

The Treasury also rejects the applicability of the US example because their taxation system is quite different to that in this country. It also argued that the US federal budget system is not one to be emulated, in part because of the high degree of rigidity in outlays, to which hypothecation contributes.

The Australian Recreational and Sport Fishing Confederation conceded that the system may be inappropriate given the pre-existing tax arrangements in Australia:

> ... That aside, it would be inequitable to emulate this system (the US system) in Australia, in view of the pre-existing taxation system.

The question of a recreational fishing licence is discussed in Chapter 6.

## 4.6 National Fishing Industry Council

The peak industry body at the national level, the National Fishing Industry Council (NFIC), is currently funded by the State fishing industry councils which in turn are funded by fishermen in each State. In many cases the money is collected by the State fishery service through a levy on State fishermen. Holders of Commonwealth Fishing Boat licences generally do not contribute very much if anything. According to NFIC:

> Some three years ago Minister Kerin agreed that some 50 per cent of this body's administration costs could be provided by an additional levy on Commonwealth Fishing Boat Licences, but subsequently departmental opposition prevented this taking place.

NFIC intends to seek from AFMA an amount not exceeding 50 per cent of its administration costs to cover its expenses in providing consultation to the Authority. NFIC's current annual budget is of the order of $150 000.

## 4.7 Other funding

AQIS inspection charges

Domestic fishermen face 100 per cent cost recovery of export inspection services by the Australian Quarantine and Inspection Service (AQIS). NFIC pointed out that the cost of export inspection in New Zealand is less that 30 per cent of what it is in Australia. According to NFIC:

> The New Zealand philosophy is simply to certify as to the integrity of the hygienic surroundings where products are prepared. It does not attempt to oversight the grading of the seafood itself, this is subject to an industry code of practice and contracts with overseas buyers.
>
> The Australian Quarantine and Inspection Service (AQIS) on the other hand intervenes at every level of export of seafood production including product standards.

In recent years AQIS has introduced various measures to reduce costs and make its systems of inspection more appropriate to the particular circumstances. AQIS is currently undergoing a process of review. At the administrative level staffings is being significantly rationalised and at the operational level new legislation is being drafted that would create a new inspection system that is more efficient and cost effective. These changes are being introduced in consultation with industry.

**Australian Maritime Safety Authority**

AMSA undertakes a range of activities that benefit fishermen. These include operation of navigational aids around the coast such as lightstations and buoys and search and rescue coordination. The cost of providing navigational aids in 1991-92 is $37 million and is recovered from the shipping industry under the Marine Navigation Levy. For vessels under 5000 tonnes the levy is 63ÿcents a tonne per quarter. Under these arrangements fishing vessels are exempt. AMSA proposes to review future needs for `navaids' and revenue sources. This will encompass consideration of the benefits derived by fishing and recreational vessels, what charges they should pay and the most suitable means of collection.

In 1990-91 AMSA was involved in 68 search and rescue incidents involving fishing vessels, seven of which were licenced foreign fishing vessels. Costs of these incidents were not calculated, however, average search costs range from $18 000 to $170 000. The cost is lower where the vessel has emergency position-indicating radio beacons and can be more easily located. There have been a number of cases recently where fishing vessels have not had this equipment. Search and rescue costs are met by the Commonwealth as a community service obligation.

Fishermen also benefit from freely provided maritime distress and safety radio communications. However, with the introduction of a new system based on greater coverage from fewer stations, fishermen will need to upgrade or replace their existing radio equipment.

Foreign fishing vessels radio their position and catch data reports to AMSA who then relay it to AFS. The cost of operating this reporting system is mainly staff costs which amount to $45 000 per annum and since 1 July 1991 this has been charged to the AFS.

**Other marine environment expenditure**

In addition to the agencies already mentioned there are a number of other publically funded organisations that are involved in the management of the marine resource. These engage in such activities as the management of the marine ecosystem, coastal zones and marine protected areas, and the protection of endangered flora and fauna. These activities are relevant to fishery resource management both because of fishing's impact on the rest of the marine environment and because of the impact of other activities on the fishery resource.

The main Commonwealth bodies involved and their funding is as follows: The Great Barrier Reef Marine Park Authority ($13.3 million), The Australian National Parks and Wildlife Service ($650 000), the CSIRO the Division of Oceanography ($12 million) and the Australian Institute of Marine Science ($16 million). The State conservation departments and agencies are also active in marine management.

In 1991-92 the Commonwealth will provide $1.7 million for the first year of a ten year marine conservation program to be known as 'Ocean Rescue 2000'. The program will produce a 'state of the marine environment report', develop a national marine conservation strategy and establish marine protected areas.

In its final report on fisheries, the Ecologically Sustainable Development Working Group, estimated that in broad terms an additional $130 million would be needed over the next 5 years to implement the programs and initiatives contained in its recommendations. These cover such matters as coastal zone management, marine pollution, the impact of fishing on non-target and by-catch species and the conservation of critical habitats for wildlife.

## 4.8 Conclusion

Under the current arrangements, the management of Commonwealth fisheries is mainly funded through the AFS budget which includes FIRDC funding. The other main source is the share of the Commonwealth appropriation to CSIRO that goes to the Fisheries Division of that organisation.

Spending on the management of Commonwealth fisheries in 1990-91 was in the order of $28 million. This comprised about $27 million for resource management, of which about $4 million was for 'role of government' activities, and at least $1 million on industry management.

Cost recovery has been largely confined to the AFS. The AFS divides its costs into recoverable and non-recoverable. These in turn are classified into fishery specific and fishery non-specific. Fishery specific recoverable costs are 90 per cent recovered through a fishery management levy while non-specific recoverable costs are partly recovered through a $395 levy on all holders of

Commonwealth Fishing Boat Licences. A concern with such cost recovery is that on the one hand it does not provide fiscal discipline and at the same time exposes fishery managers to industry pressures that may undermine effective resource management. It has also soured relations with the industry to the detriment of effective cooperation.

While some research is funded through the fishery management levy or in some cases a special research levy, most is funded by the Commonwealth. In particular, this includes funding by FIRDC and CSIRO. CSIRO funding for fisheries research appears to be vulnerable because of its low priority in that organisation.

A number of decisions have been made that affect funding under the future institutional arrangements. The Minister for Primary Industry and Energy has announced a freeze on AFMA funding at current levels in real terms until the end of 1993-94. This is likely to be an obstacle to AFMA adequately performing its responsibilities. The proposed AFMA budget for 1991-92 displays all the inadequacies of AFS with respect to limited access to research funding.

It is obvious that the funding of FRDC will be inadequate for the very real, short term task of providing sufficient information to permit the formulation of management plans which will address the serious problems evident today. Because of the way that FRDC is to be established there is a danger that its spending may not go to the areas of highest priority from the point of view of resource management. Firstly, the Corporation is being established under legislation that has an industry rather than a resource management orientation; and secondly, the Commonwealth has promised that each fishery and State will get back what it put in. Given the importance of FRDC funding, the ability of AFMA to ensure that research goes into areas where it places the highest priority will depend very much on the relations between the two organisations.

# 5 A REVIEW OF COMMONWEALTH FISHERIES MANAGEMENT ACTIVITIES

> The longer term general measure of performance for the Australian Fisheries Service (AFS) is the continued existence of healthy, self sustaining stocks of marine resources in the AFZ which support a strong, stable, viable and internationally competitive fishing industry (DPIE submission).

The new fisheries legislation and the recently announced AFMA board suggests a shift in emphasis towards a more holistic approach in fisheries management.

However, many participants in this inquiry have been critical of the Commonwealth's efforts in the past. For example, Dr Peter Young of the CSIRO Division of Fisheries said:

> Within Australia's Commonwealth managed fisheries there has been a tacit assumption that the proposed regulations in 'New Directions' will achieve the desired outcomes. This is by no means true; all of Australia's Commonwealth managed fisheries are poorly understood, and many have a history of ineffective and untimely regulatory activities, the reasons for which can ultimately be seen to be due to an unreasonable acceptance of unsubstantiated assumptions relating to resource dynamics and economic theory.

Mr Peter Peterson of SAFIC submitted that most Commonwealth fisheries have suffered overexploitation and the state of the fisheries will not improve unless fisheries managers improve their communication with fishermen and scientists. Mr Peterson stated that AFS has failed to obtain feedback on its performance and to reasses its management approach in the fisheries under its control :

> The ... question is the Commonwealth's track record in fisheries management. Fishermen are generally concerned that its track record has not been good. The collapse of the tuna industry ... the imminent collapse of the shark fishery, the failure of the scallop fishery, difficulties facing the South East Trawl fishery - there are not many positives. The question goes back to: has anyone identified what the objectives were of these exercises; has anyone set down what was achieved; has anyone gone back and looked to see what has occurred? I think the answer is no.

Many of the problems are a result of a set of complex management issues, jurisdictional and regional problems. Some of these issues have been outside the powers of AFS to influence. Nonetheless, many industry participants in the inquiry clearly felt they had not received value for money from Commonwealth fisheries management. Have the benefits of fisheries management, originally envisaged, actually eventuated? To what extent have management objectives been achieved in practice and to whom have benefits gone?

## 5.1 Management in the AFZ

To answer these questions it is necessary to put Commonwealth fisheries management in an historical and institutional perspective, and to elaborate on the objectives of fisheries management.

### Objectives of Commonwealth fisheries management

The various elements of fisheries management were outlined in Chapter 1 and 2. First there is the over-riding goal of maintaining the resources of the AFZ, which is *resource management* in its broadest sense. Then there is the goal of integrating management of fishing, both commercial and recreational, with this broader objective. This is resource management undertaken in the long term interests of fishermen. Finally there are those activities, which also can be called management, which fishermen can most effectively undertake themselves. In regard to commercial fishing these activities can be called *industry management.*

At a general level the objectives of resource management are embodied in the new legislation - and they were, maybe not as explicitly, established in the previous legislation. The Fisheries Management Act, 1991 states the AFMA must pursue the following objectives [Sections 11(1) and (2)].

> 11.(1) AFMA, in the performance of its functions, must pursue the objectives of:
>
> (a) implementing efficient and cost-effective fisheries management on behalf of the Commonwealth; and

(b) ensuring that the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of ecologically sustainable development, in particular the need to have regard to the impact of fishing activities on non-target species and the marine environment; and

(c) maximising economic efficiency in the exploitation of fisheries resources; and

(d) ensuring accountability to the fishing industry and to the Australian community in AFMA's management of fisheries resources; and

(e) achieving government targets in relation to the recovery of the costs of AFMA.

(2) In addition to the objectives mentioned in subsection (1), or in section 76 of this Act, AFMA and Joint Authorities are to have regard to the objectives of:

(a) ensuring, through proper conservation and management measures, that the living resources of the AFZ are not endangered by over-exploitation; and

(b) achieving the optimum utilisation of the living resources of the AFZ;

but must ensure, as far as practicable, that measures adopted in pursuit of those objectives must not be inconsistent with the preservation, conservation and protection of all species of whales.

In the Fisheries Act 1952 the objectives were expressed as follows:

5B...(a) ensuring, through proper conservation and management measures, that the living resources of the Australian fishing zone are not endangered by over-exploitation; and

(b) achieving the optimum utilization of the living resources of the Australian fishing zone,

but shall ensure, so far as practicable, that measures adopted in pursuit of those objectives shall not be inconsistent with the preservation, conservation and protection of all species of whales.

The Government Policy Statement of December, 1989 ('New Directions for Commonwealth Fisheries Management in the 1990s'), said the proposed management is 'based on the need for ecologically sustainable development of fisheries resources and it recognises the need to integrate development and environmental objectives'.

A statement by the present Director of the AFS, made in early 1991 (Gorrie 1991, p. 1) illustrates the dimensions of modern fisheries management, highlighting that it encompasses an ecological approach to sustainability for the benefit of all users.

> Today's fisheries managers are increasingly asking the question; "Is fishery management about commercial fishing only or should it be something more?" Although many in the community may not explicitly realise it, a fishery is a community owned natural resource with an increasing number of demands being placed on it. Governments therefore have responsibility for its stewardship and must, on behalf of the community, balance the different demands of all those who might wish to legitimately use the resource.
>
> Fisheries management is evolutionary. Up until early this century the prevailing view was that the marine resource was immense and that there was no need for management. The period between the two World Wars saw a realisation that the resource was, after all, not infinite and that there was some need to regulate fishing. Post World War II witnessed a recognition of the importance of economic factors in resource management, and more recently, has seen the development of a wider ecological approach as being necessary to underpin sustainability of the resource. Hand in hand with the recognition of ecological factors is the emerging need to accommodate a wider spectrum of potential users.
>
> To a large extent, fisheries management in Australia has been mainly about commercial fishing rather than resource management. While commercial fishing is obviously very important and fishing is the principal user of the resource, it is by no means the only user. The aquatic resource, including the environment and ecosystem that nurtures it, is subject to an ever increasing number of demands.

Recently there has come about a recognition that fisheries management extends beyond the activities which occur in the marine environment. Some participants in this inquiry drew attention to the fact that what happens on the adjacent coast can adversely impact on fisheries. DrÿKearney, Director, New South Wales Fisheries Research Institute, commented:

> There were things like habitat destruction, water quality drops ... which ... were in some cases quite likely having an impact exceeding both the commercial and recreational fishing on the resource.

Mr Kelleher, Chairman, GBRMPA, stated:

> I see there is a very strong ecological linkage between what happens on the coast on the land and happens on the coast in the water. So I see it as very important that there be a process for integrated consideration of the land and the water and the coastal zone.

Mr Peterson, Executive Director, South Australian Fishing Industry Council, stated:

> The Commonwealth has a role ... [which] pertains to questions of pollution and coastal management in ensuring that an overview of management ensures that states are adhering to a particular set of guidelines.

The Queensland Commercial Fishermen's Organisation has taken a direct interest in coastal zone developments and employs qualified staff to work to promote conservation of mangroves and address pollution problems. The Western Australian Fishing Industry Council also employs an environmental officer who is involved in similar work.

While coastal land uses are the responsibility of the States and their local government authorities, a comprehensive approach to fisheries management would mean that all levels of government have a real interest in how activities on the adjacent coast impact on the uses and productivity of the marine environment.

The existing and potential users of the marine environment are many, be they those who utilise the marine environment to produce fish for sale, recreational fishermen who seek fish to supplement diets and/or engage in fishing for pleasure, recreationalists who enjoy the underwater environment by diving and snorkelling, tourist operators whose business is to provide access to that environment and those who gain pleasure and benefits by knowing that certain species and/or sites are protected for all time.

These are relatively new challenges for managers of the marine environment and, therefore, there is little in the way of history to draw on to assess the success or otherwise of management. As Mr Gorrie states, until now the emphasis of fisheries managers has been on commercial fishing - undoubtedly the most important user of Commonwealth fisheries. The major objective has been to restructure what where historically open-access fisheries so that economic efficiency is promoted. In a dynamic context this objective is not inconsistent with ecological sustainability. Nevertheless, tensions between the short term financial interests of commercial fishermen and the long run viability of commercial fishing have made the management task very difficult.

Only in specific locations have Commonwealth agencies been required to explicitly address resource management in its broadest sense. The AFS has had to involve itself in resource management - to a limited extent - in the Torres Strait, as a consequence of the Torres Strait Treaty. The Treaty requires that, inter alia, the way of life and livelihood of the traditional inhabitants has to be preserved and this has meant that attempts have been made to ensure the continued existence of stocks for subsistence fishing, and it has also aimed to conserve stocks of dugongs and green turtles. These objectives have had to be addressed while allowing commercial fishing for prawns, rock lobsters and fin fish, and simultaneously achieve the objectives of resource sharing between Australia and Papua New Guinea (see Appendix G for a more detailed discussion).

These objectives for the Torres Strait fisheries involve the two central features of resource management, sustaining the valued uses of the area and allocating uses between competing demands. Other than in a very general sense is it possible to judge the success of the management of the Torres Strait. There is no available evidence to suggest major problems exist in the sharing arrangements between the two countries. It is not known whether or not the program of reducing outside commercial involvement is increasing the participation of Islanders in fishing. There is some evidence that there has been a decline in the numbers of dugong and green turtles. With regard to the latter, it may be impossible to prevent or reverse a decline because the animals travel enormous distances and harvesting outside of the Torres Strait is beyond the control of Australian managers. Stocks are declining on a world basis.

The other location where a Commonwealth agency is specifically required to undertake resource management is the Great Barrier Reef Marine Park. The responsible body, the Great Barrier Reef Marine Park Authority (GBRMPA), has a legislative requirement to manage the resources of an area approximately the size of Victoria for multiple uses (see Appendix G). The uses include commercial fishing, recreational fishing, fishing and hunting by traditional users, tourism and general recreational uses. GBRMPA is not involved in direct fisheries management, which is undertaken by the relevant Queensland agencies. It does affect fishing by its zoning plans and regulations (including some gear restrictions) and it attempts to allocate access such that incompatible uses are separated. The agency has had over a decade of involvement in management and the evidence suggests that it has been successful to date in achieving its broad objectives. Its management strategy is to 'optimise' the use of the Great Barrier Reef by taking into account biological, financial, social, legal and political factors - to the extent that such is possible.

Except for these two examples, any assessment of resource management undertaken by the Commonwealth needs to be confined to considering the narrower goal of achieving economic efficiency in a commercial fishery within a constraint of sustaining stocks. Any assessment has to recognise the historical perspective as a baseline; that is to say that Commonwealth management was only implemented fairly recently and the major Commonwealth fisheries already had a history of open access.

In terms of the delineation used in this report to separate types of management and the beneficiaries of management, what in a general sense AFS has attempted to achieve in the major fisheries is the dual objectives of restructuring the fisheries (for the benefit of fishermen) and resource management (for the long term benefit of fishermen). By and large it has not had to deal with conflicts between other users, as recreational fishing was the responsibility of the States and other demands were not significant.

**Management of individual fisheries**

Appendix G discusses the management of the major Commonwealth fisheries in some detail. Here brief assessments of the success or otherwise of management are made.

*Northern Prawn fishery*

The Northern Prawn fishery commenced in the late 1960s. When management was introduced it was shared by the Commonwealth, Northern Territory, Queensland and Western Australian Governments. This was the situation until 1988 when AFS became the sole manager. AFS inherited a fishery which had progressed from open access to limited entry in 1977. Technological change meant that fishing capacity continued to increase after the introduction of limited entry. A complex set of input controls on gear, area and seasonal closures comprise the management techniques. Economic studies undertaken for the years 1974-75 to 1977-78, 1980-81 and 1981-82 and 1985-86 showed that the fishery was over-capitalised and would benefit from a reduction of the fleet. The most recent study, by ABARE, indicated that at least $38 million in potential management rents were being dissipated annually.

In 1985, agreement was reached between the various commercial fishing groups and the various governments to implement a voluntary buy-back scheme. The fact that this occurred years after there was evidence of severe over-capitalisation is indicative of the difficulties involved in getting agreement when a variety of interests are involved. As a voluntary scheme, it needed to be agreed to by industry, but for the greater part of the history of the Northern Prawn fishery, industry was not a unified force. There were different attitudes held by the owner-operators and the company operations and there were State/Territory differences of opinion.

The original buy-back scheme had only limited success and AFS set about obtaining agreement from industry for a compulsory buy-back scheme, which was recently put in place. To obtain agreement the Commonwealth provided a grant and a loan guarantee.

History will determine the degree of success of this scheme. As an input controlled fishery it can be expected that additional effort reduction will be needed sometime in the future. A fundamental issue which may not have been considered in enough detail in putting in place a compulsory buy-back scheme is that the boats and fishermen are likely to have limited opportunities to transfer to other productive activities. If that is taken into account the efficient amount of effort reduction should be much less than suggested by simple financial calculations.

It is obvious that considerable management resources have been applied to devising input controls and obtaining agreement on restructuring. As with all input control schemes there is a continuing need to refine them as a consequence of fishermen seeking to increase their individual fishing capacity by modifying the uncontrolled inputs - something they have done successfully in the Northern Prawn fishery. It could be argued that the managers of the Northern Prawn fishery should have acted more promptly in addressing the over-capitalisation problem, but the need to reach a consensus between Governments and obtain agreement from a divided industry have to be taken into account. To the extent that this aspect of management has been a failure - that is, should have occurred much earlier and with less expenditure by managers - reflects a failure of the institutional arrangements.

The other aspects of management which need consideration are surveillance, monitoring (through the log-book program) and research. Surveillance has been criticised by industry representatives for being too costly. This raises the issues of whether or not the program is the most appropriate in the circumstances and, notwithstanding that, whether it could have been provided at lesser cost. The Commission was provided with insufficient evidence on either of these matters to form a definite view. It does note that, for apparent institutional reasons, the task was shared by agencies of two governments. Further, it notes the claims made by some participants that one agency, the Northern Territory Police Force, undertook normal policing activities in conjunction with surveillance and hence some apportionment of the costs would have seemed appropriate. Finally, the Commission notes that the industry believes it could have had the surveillance undertaken at lesser cost by using a tendering system and contracting other service providers, but it also notes that the specific nature of surveillance and enforcement (ultimately a policing function dependent on the authority of the State) means that there is very limited scope to engage outside providers.

The log-book program was also criticised by industry representatives as being too costly. Without in any way diminishing the essential integrity of a log-book monitoring system, it could be planned to be more cost effective (refer to Monitoring section in this chapter).

The Northern Prawn fishery has benefited from a long-running research program undertaken by CSIRO, a program which commenced in the very early days of the fishery and has been essential in maintaining the financial viability of the fishery. CSIRO scientists based at the Cleveland Marine Laboratory have developed a rapport with industry and their work is often cited as a model of scientist-industry interaction. The science has tactical and strategic emphases, but the strategic

research cannot be divorced from the short term practical research as the latter requires the former as a basis of continued progress. This means that to a significant extent the industry is the beneficiary of both types of research.

The Commission is not aware of any criticisms of the CSIRO research undertaken for this fishery. CSIRO's Cleveland laboratory has effectively undertaken resource management in this fishery, while AFS's role has been confined to fishing industry management, including administration and compliance. CSIRO notes that industry is reliant on the research but is of the opinion that industry would not be willing to pay for the full amount of research that the Director of the Cleveland Marine Laboratory considers necessary for the continued (relative) success of the fishery.

*Southern Bluefin Tuna fishery*

Southern Bluefin Tuna is a migrating species. It is fished by Australian, Japanese and New Zealand fishermen in Australian waters, and outside of Australian waters the fish are caught by fleets from Japan, Korea, Indonesia, Taiwan and New Zealand. This international feature of the fishery complicates management.

The history of the management of the fishery is presented in Appendix G. Some key features are summarised here. Voluntary seasonal closures were adopted by the Japanese longline fleet in 1971. In 1975 a freeze on entry to the Australian purse seine fleet was introduced and purse seining was banned in Western Australia. In 1976 the entry of new pole vessels was prohibited in waters managed by South Australia, Victoria, Tasmania and New South Wales. A limited entry regime was introduced in the fishery in the same year. In 1981 the limited entry regime was abandoned, on the basis that it had been ineffective in stabilising investment.

Management of the Southern Bluefin Tuna fishery was complicated and frustrated by the fact that a number of States were involved and the interests of different groups of fishermen and different governments did not coincide. In 1982, a Senate Committee reviewed the management of the fishery and found that there had been a failure to restrain effort and that the fishery should not be left unmanaged.

From a peak catch in 1961 the catch had continued to decline. The first warnings by scientists of over-fishing were made in the late 1970s. On the basis of repeated warnings by scientists and the Senate Committee's recommendations, an interim management plan was put in place in 1983, the crucial feature being a global catch limit. In 1984, after investigations by the Commonwealth Department of Primary Industry and the Industries Assistance Commission, full management responsibility was given to AFS. A TAC was set and ITQs issued to Australian fishermen.

History proved the TAC to be too high and reductions have continued. In 1988, a trilateral scientific report suggested that 'the only safe catch' would be zero and in 1989 the Prime Minister announced that the Australian Government would press for a moratorium.

It is obvious that the Commonwealth was given management responsibility for a fishery which was over-capitalised, over-fished, subject to scientific disputes between the international parties and between fishermen and scientists, and subject to differences of opinion between State Governments and different sections of the industry. A more difficult task for managers could not be envisaged. Furthermore, there was the additional difficulty of allocating individual quotas in an equitable manner and which was also acceptable to fishermen with conflicting views.

A positive aspect of management was that the ITQ system allowed a natural restructuring of industry. Two specific aspects of restructuring warrant mention. One is that some fishermen were able to exit the Southern Bluefin Tuna fishery and move into the South East Trawl fishery, which increased the over-capitialisation of the latter. The second is that the price paid for quota was high given the warnings by scientists that the TAC was not sustainable at the existing level. Both of these factors made restructuring very easy and rapid. The consequences were felt later.

If the scientific assessments are correct, the management failure has been in setting a sustainable TAC. That problem precedes Commonwealth management. It is complicated by the international characteristics of the fishery and the scientific uncertainty involved in fisheries science. Had managers taken a conservative, risk-averse position (which would appear to be justified in fisheries management) they would have faced even harsher criticism from some sections of industry than those to which they have been subject. Nevertheless, as scientists have argued, had the early warnings of over-fishing been heeded the present yield and profitability of the fishery would have been much higher than it presently is.

As agents of owners, the resource managers should be expected to take risk-averse decisions, but they need public support to do so in the face of industry criticism. The problem industry has faced, and faces, is the trade-off between long term profitability and the short term dictates of investment decisions. Both management - but only to a limited extent Commonwealth management - and industry are responsible for problems faced in the Southern Bluefin Tuna fishery.

Other aspects of management are less controversial. The method of allocating access to foreign fishermen is based on negotiated payment of access rights. The payments for these rights and associated management costs can be assumed to reflect their economic value. Surveillance, enforcement and monitoring are not major issues, although fishermen would like to see the costs reduced. The Commission has no clear evidence to suggest that the costs are extensive, but it would expect that with the significant decrease in the domestic fleet, both administrative and monitoring costs should have been reduced in real terms from what they were at the time of introducing ITQ management.

Fundamental to the future successful exploitation of the southern bluefin tuna is an understanding of the stock dynamics. This understanding has been building on the research effort of past decades but the models used to-day still contain considerable uncertainty. Clearly more research is required. It is unlikely that industry would be willing to pay for the necessary level of research, notwithstanding that sound investment decisions in the future can only be based on the knowledge research provides. As with most research efforts in fisheries, the time scale of benefits to industry is important in terms of who should pay and when. This issue is even more dramatic if a fishery has to be closed to allow stock recovery.

The lesson that both managers and fishermen should heed from the experience is that where there is significant uncertainty as to the sustainability of a TAC this should be made explicit (and if there are reasonable expectations that the TAC will have to fall over time, this should be emphasised to all interested parties including financial institutions dealing with fishermen), and fishermen should restrain their normal optimism.

*East Coast Tuna fishery*

The East Coast Tuna fishery is not a major commercial fishery. The real interest in it for present purposes is that of all the Commonwealth fisheries there is a significant recreational sector involvement.

The fishery extends down the East coast from the tip of Cape York to the southern-most waters of the NSW coast. In the northern parts the catch comprises yellowfin and bigeye tuna and albacore, while in the southern area southern bluefin tuna is caught as well as these species. There are 169 commercial boats endorsed to longline. Skipjack tuna are targeted by a small purse seine fleet.

Jurisdiction is primarily a Commonwealth responsibility, but not entirely as OCS arrangements with NSW have not been finalised. Both the longline and purse seine fisheries are managed under so-called 'interim arrangements' as a limited entry fishery. Entry limitations were only announced as recently as 16 July 1991 for tunas other than southern bluefin tuna (which are under the Southern Bluefin Tuna fishery arrangements discussed previously).

There is significant participation by recreational fishermen, who are estimated to account for about 25 per cent of the yellowfin tuna catch. Recreational fishing interests have had an involvement as official observers on the management advisory committee, ECTUNAMAC, since its inception in August 1986.

It is obvious that effective management requires attention to all fishing effort, both commercial and recreational. Until the enactment of the AFMA legislation, the Commonwealth left management of recreational fishing with the States. This was the situation notwithstanding its constitutional ability to be involved. Under the Australian Constitution the laws of the relevant State apply in waters where the Commonwealth has jurisdiction if there is no conflict between the laws of the two levels of Government. The Commonwealth did not exercise this power under the previous legislation.

The Commission was not presented with evidence to suggest that there was over-capitalisation or biological over-fishing of East Coast Tuna, although economic theory would suggest that over-capitalisation would exist as a consequence of a history of open access. The major issue drawn to the Commission's attention was the real or perceived conflict between commercial and recreational fishing. This has not been adequately addressed as a resource allocation matter. The heart to the problem is the fact that NSW has not agreed to an OCS arrangement.

Underlying this problem is that little research has been undertaken for this fishery. For instance, it is not known whether the stock is Australian (from the Coral Sea) or is part of a broader Pacific stock. Large increases in catches in the last 12 months was thought to be due to changes in ocean currents and water temperatures.

*South East Trawl fishery*

The South East Trawl fishery extends from Barrenjoey Point (North of Sydney), south around Tasmania and West to Cape Willoughby in South Australia. This fishery contains a large number of sub-fisheries, some of them established for a very long time to provide fresh seafood to the Sydney, Melbourne and other adjacent markets. The fishery expanded dramatically in the 1980s with the discovery of deep water species, blue grenadier first then orange roughy.

What differentiates this Commonwealth fishery from some others is that the waters are almost exclusively under Commonwealth control but OCS arrangements have not been agreed to. This has a number of consequences, some of little consequence (such as the requirement by each State that fishermen have to have State licences before fish can be landed and sold) and others of major consequence (managers from four States as well as the Commonwealth are involved). Not only is management severely limited by the involvement of five Governments but it is bedevilled by sectional interests within the fishing industry A further compounding factor is the fact that fishing in inshore State waters impacts on the offshore fishery. Probably of most significance in this regard is the very substantial recreational inshore fishing effort. It also should be noted that some commercial species (for example, snapper) are caught by recreational fishermen in Commonwealth waters.

Management of the South East Trawl fishery cannot be considered a success - and will not be until a single comprehensive management regime is put in place. The past management can be categorised as 'stop-go' and tentative, with dramatically conflicting management philosophies colliding head-on (the laissez-faire position of the past NSW managers versus the economic principles advanced by the Commonwealth). Fishermen claimed they were 'encouraged' to invest - some claimed that the management techniques used provided incentives for investment in inappropriate vessels and gear - by the enthusiasm of managers who were concerned to ensure that Australian fishermen fully utilised the AFZ (and thereby eliminating the prospect of foreign involvement) and by optimistic estimates of the resource by scientists. On the other hand, managers (particularly in recent years) issued warnings not to over-invest.

One of the most contentious issues - and one which has re-emerged with the proposal to issue ITQs for the major species - has been the allocation of fishing rights. Both timing and entry criteria are subjects of concern. Announcement of changed management regimes were usually made well in advance of implementation, leading to a rush of boats to meet the criterion of past fishing. Fishermen differed as to what should be the entry criteria and boat replacement rules.

The administrative costs involved in doing little more then obtaining agreement between the parties (the various Governments and the 'factions' in the industry) surely must have been higher than necessary - as it must be in any area of public administration where there are over-lapping jurisdictions. Until an OCS arrangement is agreed which places the responsibility of the fishery (from the coast to the 200 mile limit) with one body, this element of the cost of management will remain higher than necessary. The Commission notes that there has been a significant reduction in administration and licensing costs in 1990-91 with the transfer of these functions to the Commonwealth.

Aspects of on-going management (surveillance, enforcement and monitoring) are possibly costing more than they would under single-agency management. The Commission has not been able to form a definite view on this.

What the experience of rapidly declining catches of gemfish and orange roughy illustrates is the crucial need for scientific research in the South East Trawl fishery. Scientists have estimated that very substantial sums of money will need to be spent on the fishery in the next few years. The amounts in question are far beyond the capacity of the industry to pay at present, yet in the long term, the financial viability of the industry will depend on the research.

*Southern Shark fishery*

The Southern Shark fishery is a very old fishery, with commercial catches first recorded in the mid-1920s. The fishery extends from the eastern Victorian border, around Tasmania, to the western South Australian border. To the seaward limit of three nautical miles State controls are in force. While the remainder of the fishery is under Commonwealth control, OCS arrangements have not been agreed to.

The problems resulting from this institutional situation are various and severe. In State waters, shark fishing is either uncontrolled or different controls are used to those in Commonwealth waters. Most fishermen also operate in other fisheries (particularly the rock lobster and/or scallop fisheries) which are subject to different OCS arrangements. There is considerable recreational fishing in the State waters which impacts both directly (by catching shark) and indirectly (by influencing the food chain) on the fishery. In these regards, management of the Southern Shark fishery has suffered from the same inappropriate institutional arrangements as exist in the South East Trawl fishery. Furthermore, again like the South East Trawl fishery, managers are confronted by different demands from opposing sectoral interests in the industry.

By the early 1980s effort had increased significantly from what it was 10 years previously. With this increase in effort, total catch increased, peaking in 1986. Since then the catch has declined and some scientific assessments have suggested the complete closure of the fishery for an extended period to allow stocks to recover. As the discussion in Appendix G shows, Commonwealth managers warned against further investment in the fishery from as early as 1984, yet investment increased. That history also illustrates the difficulties of obtaining agreement when various parties with their own self-interest to advance are involved.

Some fishermen blame the managers for the present over-capitalised and severely over-fished fishery. However, management decisions are a result of long, drawn-out consultations with industry which has often resisted the 'hard' decisions which probably should have been made.

*Summary*

The brief reviews of Commonwealth management of the major Commonwealth commercial fisheries illustrate the difficulties involved in putting in place optimal resource management, which aims to ultimately benefit fishermen.

One very important impediment has been - and is - the jurisdictional split between fisheries. Numerous participants drew attention to this issue. For example, MrÿJÿEvans, a Tasmanian rock lobster fisherman, submitted that:

> ... if you have a resource like rock lobster which extends over three states it should be under one jurisdiction whether they like it or not.

Mr McCormack, Acting Director, Fisheries Management Division, Victorian Department of Conservation and Environment, in commenting on the problems in managing the Southern Shark fishery, observed:

> ... the difficulties have been with getting the states and the Commonwealth to agree as to what is the best course of action to take.

While the OCS is the means whereby jurisdictional problems can be resolved, a number of participants stated that it has not been used to its potential. For example, Mr K Evans, Assistant Director of Sea Fisheries, Tasmanian Department of Primary Industry, acknowleged:

> ... there are instances where the OCS agreement has not been used to its ... maximum efficiency or effectiveness ...

It is the Commission's view that Commonwealth management since the OCS has not been a failure purely of its own making. Rather all parties have to share the responsibility for the state of fisheries considered in this report.

## Recreational fishing

The Commonwealth's attention to recreational fishing in the past has been very limited. The recognition that recreational fishing is a very important activity and that there are inter-relationships between it and commercial fishing mean this will change. What Dr Kearney, Director, New South Wales Fisheries Research Institute, stated about the relationship between recreational and commercial fishing, and the effect of increased recreational fishing on recreational catches, in New South Wales is illustrative of a more widespread situation:

> ... when we researched a lot of the recreational and commercial fisheries issues ... we very quickly found that there were more problems than just the effect of commercial fisheries on recreational fisheries ... What we did find in a couple of cases was that in fact the reverse of this was the case, and that is that the recreational fishery was in fact having a severe impact on the commercial fishery because the recreational fishery was increasing far more rapidly than the commercial fishery was ... [and] the recreational fishery, contrary to people's belief, was having a huge impact on itself ... one of the primary reasons for the decline in catch per unit of effort was simply the increase in the effort in the recreational fishery.

With a resolution of jurisdictional problems in the Southern Shark and South East Trawl fisheries, and greater pressure on the tuna fisheries from both commercial and recreational fishermen, the Commonwealth will have to be more involved in recreational fishing in the future. The new legislation gives it a duty and responsibility to be involved. Recreational catches will have to be included in TACs and resource management plans will have to include measures to regulate recreational fishing. Recreational fishing will have to be part of the surveillance and enforcement program.

These changes imply that recreational fishermen will need to be included among the users involved in developing management plans. A number of submissions argued that recreational fishermen should be included on relevant MACs and on the AFMA board. They also recognised that a corollary was that recreational fishermen should contribute towards the costs of management. However, two of the fisheries most affected, Southeast Trawl and tuna, are those where management is most affected by inadequate knowledge. Little is known about recreational catches of fish which are also targeted by commercial fishermen, nor about the impact of inshore recreational fishing on recruitment of juveniles of deeper water species. It is presently impossible to determine both recreational fishermen's share of catches and the benefit they derive from resource management.

Incorporating recreational fishing in fisheries management will require addressing the issue of resource sharing. As Mr Rogers, now Executive Director of the Western Australian Fisheries Department, observed:

> ... it is always a difficult area that no one effectively in the Australian context I believe has fully addressed ... one of the challenges of fisheries management in the next 5 to 10 years has to be addressing that particular issue.

## 5.2 Research

Fisheries research is a basic requirement for effective resource management and is also important for industry management. Scientific research for resource management is necessary to provide knowledge of such things as marine ecosystems, particular fisheries information (including biology, stock size, population dynamics, effects of fishing), and ultimately the maximum sustainable yield (MSY) and the way it should be achieved. Social and economic research can help to determine optimal allocation of fishery resources among competing users, both present and future as well as to develop regulatory systems.

The need for more research for the purpose of improving management decisions was emphasised by many participants in this inquiry. Mr Hamer, Principal Fisheries Manager, Marine, New South Wales Fisheries Department, stated:

> ... there is not enough information for good resource management ... Certainly my personal view as a fisheries manager in providing advice to the Director and the Minister is that we are not spending enough - not anywhere near enough ...

Mr Rogers, of the Western Australian Fisheries Department, said:

> ... one of the most fundamental strengths in terms of reasonable fisheries management in Western Australia ... has been ... adequate research, long sustainable research ... I think there is much more to do in terms of the Commonwealth managed fishery ... If you want to pick a key parameter in terms of managing Australian fisheries, I think that is it. That is what makes it or what makes it fail ... without long-term good data bases, any chances of managing fisheries will go out the window ... unless you as a manager know that you have a research structure and the supporting data is there and the long-term data bases are there, you will get it wrong and you will reap rewards a few years later ... at the end of the day the key strategy which will make good fisheries management ... is good research, good long-term research, good research structure, good integrated research and good processes between liaising with the client groups ... at the end of the day the research is that which underpins the management decisions ... If you want to get out of the strife that Australia is in in terms of fisheries management, I think the key priority is adequate funding of research ...

Dr Reichelt, Acting Director, Fisheries Resources Branch, BRR, stated:

> [Research] is a fundamental underpining to any form of resource management ... the [fishing] industry is ... the primary long-term loser when sufficient research has not been done to allow effective management to be put in place.

The need for research with regard to recreational fishing was also recognised. Dr Pepperell, consultant to the Australian Fishing Tackle Association, commented:

> It is very difficult to manage a species if you do not have ... basic biological knowledge.

Mr Rogers, pointed to:

> There is a huge void in terms of research in Australia ... It is in the area of recreational fishing and the impact on inshore fish stocks.

Another area of research which was identified by participants pertained to the impact on non-target species. Mr Anderson, Co-ordinator, Marine Conservation Unit, ANPWS, agreed:

> ... the impact of fisheries on non-target species is an industry responsibility and that then brings us, quite clearly, directly to the question of cost recovery for the research and the studies required to deal with by-catch.

Mr Anderson also identified that social research may be important in formulating management for traditional fisheries, such as in the Torres Strait.

> The sorts of research that may be required may involve a cultural assessment of levels of need within the community and that may be an extremely important component of any decision on setting catch limits.

### Adequacy of research

There is concern about the adequacy of research, particularly about priority setting. Industry participants in the inquiry recognised the importance of research, but were critical of what is currently done by both the Commonwealth and the States. These criticisms were that much research has been:

- too costly;
- of poor quality;
- the wrong kind, priority has not been given to important industry management problems;
- reactive rather than proactive, resulting in necessary research being undertaken too late; and
- insufficient integration of economic research with biological research.

Some of these views are reflected in the recommendations in *the Review of the CSIRO Division of Fisheries* (CSIRO 1990, p. 7) that: `... objectives must address real world problems, be outcome driven, and measurable'.

How justified are these criticisms?

**Cost**

Research accounts for about half of total outlays on management in Commonwealth fisheries. This amounts to over 6 per cent of the gross value of commercial fisheries production, a rather high figure when compared with the overall R & D expenditure for all sectors of the Australian economy of 1.2 per cent of GDP for 1988-89, and 2.6 per cent for agriculture for 1986-87 (Grey and Copland, 1991).

In real terms, the trend in fisheries research funding has been static if not declining, while the value of production has steadily increased (BRR 1989 Meeting The Needs Ahead). While the CSIRO appropriation funding remains the largest single source of Commonwealth funds dedicated to fisheries research, it has declined by around 40 per cent in real terms over the decade.

There is little doubt that relative to many other research areas fisheries research is relatively costly. Going to sea is costly, especially in dedicated research vessels or on chartered voyages. The three dimensional aspect of the marine environment makes research a far more complex matter than research in terrestrial environments. Whether and to what extent research is more costly than it need be is difficult to determine. While many fishermen argue that more use could be made of their vessels and labour in research on their fisheries, scientists say that they need to use specialised scientific equipment and survey techniques that are not amenable to use by fishing fleets. Certain elements of costs, such as CSIRO's sea loading for its staff of about $1200 per week, would, on the face of it, make CSIRO research unnecessarily expensive.

It is likely that the cost of research is higher than need be due to the duplication of work done by various bodies. Mr Peterson, SAFIC argued:

> Now, one of the classic points of criticism of fisheries research - in particular the South-east trawl fishery - is that we have the CSIRO, the Victorian department, the New South Wales department and the Tasmanian department conducting similar research on similar species ... duplicating each other's work and basically wasting resources ...

Mr Rogers, Director of Fisheries Management Policy, Western Australian Fisheries Department, commented on the need for coordination of research effort:

> Australia can ill afford poorly coordinated research. There has been too much emphasis in Australia on biological research and not enough emphasis on what I would call fisheries science and I think that is a real problem for Australia ... coordination of research not only has to flow from state authorities and Commonwealth authorities; it has to spread across the universities and so on ... We can ill afford duplication.

Another reason for the seemingly high cost of fisheries research relative to the value of commercial fishing production is that some of the research effort is directed to the needs of the multitude of users of the marine resource. The benefits from research of the marine environment can be dispersed widely. Benefits accrue to the community generally in the case of conservation fisheries such as the Great Barrier Reef Marine Park. The tourist industry has benefited from research which pertains to such matters as marine pollution and damage to reef ecosystem by the Crown of Thorns Starfish, to give two examples. Recreational fishermen also benefit from research, which, for example, relate to recruitment, tag-and-release programs and ciguatera poisoning.

In comparing the cost-effectiveness of fisheries research, it is not appropriate to consider only the value of the commercial catch, since commercial value is only one of the many values of marine resource use. These include social and environmental benefits which are not priced by the market (except in the case where benefits incidentally flow on to commercial fishermen) and therefore do not contribute to the commercial value of fisheries production.

It is recognised that research which provides a better understanding of the marine environment and stock dynamics (which can be used for setting sustainable TACs) ultimately benefits the commercial fishing industry. By being better informed on such matters fishermen would have more confidence in making investment decisions (purchasing vessels). Until the relatively recent experience of reduced TACs it is not obvious that fishermen, or at least a major proportion of them, saw the need for this type of research. In the past, their willingness to pay for such research was likely to be less than that which is needed. Even in the changed circumstances today, it is not obvious that all, or most fishermen, would pay for the appropriate type and level of resource-management oriented research. The extent to which industry is willing or able to pay for research which will ultimately benefit it is a crucial issue.

MrÿRÿLewis, Director, South Australian Department of Fisheries, expressed his concern that industry would not adequately support long term research:

> ... one of the things which is lacking, and to be recognised in Australia is the need for long-term research projects ... there are some sectors of the fishing industry in South Australia who are highly committed to research and see the need for the long-term horizon and the broader perspective and guarantees that that continues. My concern is that will not be guaranteed by the vast majority of the fishing industry, who may have a shorter term horizon.
>
> I will stress that because of that, I do have great misgivings about the advice and recommendations and discussion, which is currently taking place at both the state and national level, for industry to take over some of these areas.

On the other hand, Mr McCormack, of the Victorian Department of Conservation and Environment, believed that fishermen who took the view that fishing was a `whole of life occupation' would pay for research:

> So they accept the need to obtain scientifically based information on what is happening to the resource and I believe they are prepared to pay for that in the form of licence fees or resource rents or whatever.

With regard to research being undertaken for the Port Phillip Bay scallop fishery he stated that:

> ... [the Victorian Government] has already indicated to the scallop industry that the cost of the ... trials that are going on now should be met by them ... The government indicated in its budget papers this year that the cost will be paid by the scallop fishermen ...

Dr Reichelt of BRR, commented on industry's attitude to research:

> Australian scientists are acutely aware of the impact their advice is having on the fishing industry - partly through the action that managers take on the strength of that advice, and partly through the reaction of the industry itself. I must say that reaction is extremely varied and ranges from close cooperation and debate, through to the other unfortunate extreme threats of legal action, physical threats and death threats.

He also suggested that the amount of money industry would pay for research would 'fall below what is actually needed to provide an assessment for all parties concerned'.

One expression of industry's perspective was presented by Mr Walkear, Executive Officer, Trawler Owners' Association, who commented on the situation in the South East Trawl fishery:

> ... despite the fact that we have had a virtual army of biologists in existence as long as I have been fishing - I started in 1954 - that when you come to the crunch and ask them what they know about the current species they can tell you nothing ... So you will have to ask yourselves the question: what have the biologists been doing for the last 20 years? ... However ... that is water under the bridge. We hope we have turned the corner and that things are going to be different from now on and that there will be a far closer liaison and far more cost benefit applied to future practical research on all our species.

Mr Jeffries, Chairman, NFIC, in discussing cost recovery for management generally also argued for a cost benefit analysis:

> ... before you spend money ... go through a simple cost benefit analysis ... whether this is the best use of the money in the fishery ...

These comments, and the view expressed by CSIRO with regard to the Northern Prawn fishery, indicate that commercial fishermen, in most circumstances, would not pay enough to have the necessary research undertaken. One reason is that short term financial factors can outweigh long term profit maximising behaviour. Another reason is that some fishermen believe that in the past they have not received benefits from research. However, there is an expectation that this may change with greater attention being paid to the costs and benefits of research. There is very little information available to indicate the amount of money other users (such as recreational fishermen and charter boat operators) are willing to pay for research which is likely to benefit them.

For all users of the marine environment (as for the Australian public generally) there is likely to be a poor understanding of the amount of money spent on marine research. In fact, there is likely to be a minimal understanding by the public of the expenditure on research generally. This is because most research is publicly funded, primarily because of its public good features. One challenge in allocating funds to research is to separate the private good elements from the public good ones. Another challenge is to determine the amount which should be spent on public goods research. Economic theory indicates that too little will be spent if the decision is left to the market. This same principle is likely to be an influence on individual commercial fishermen. Each can be expected to be primarily concerned with the private benefits he can gain from research. Scepticism about private benefits will be stronger the weaker the property rights fishermen have. As there is a hierarchy of such rights, being the weakest where licences are issued for a short period or in a fishery managed by a competitive TAC and strongest in an ITQ managed fishery, it could be expected that willingness to pay for research would mirror this.

These very real difficulties stated, it is important for efficient and effective resource management that research resources not be squandered, but be used in the most productive way. It is therefore important to ask whether research has contributed effectively to Commonwealth resource management. Has the appropriate research been done, and has it been used? Is the priority setting process such that research resources will be allocated in the most efficient way?

**Quality of research**

The criticism that research results are not accurate enough is sometimes levied at research projects which are simply inadequately resourced. At times, because of the urgent demands for stock assessment (for example, where a TAC has to be set), some research which has been used in resource management of Commonwealth fisheries has not been through the conventional scientific processes of publication and peer review. Its quality has been questioned as much because of the process as because of the results. In other cases, the quality is a reflection of little research being done in a particular area - first attempts are unlikely to produce definitive results. This is a particular problem where research is not brought to bear on resource management issues until severe problems become apparent.

Sometimes, people expect too much from research. Research by its nature is an 'uncertain business' in any discipline and is particularly so in fisheries. Unfortunately many people seek certainty as a basis for decision making, and do not understand that it can never be forthcoming. Furthermore, many people interpret vigorous scientific debates as evidence of bitter divisions within the scientific community without realising that the debates relate only to what is not agreed, not to the vast areas of agreement.

Some scientists do not help matters by failing to communicate effectively with those in government and industry who need to use their findings. Many Commonwealth fisheries are characterised by poor communication between scientists and those in industry and fisheries management. All of the fisheries which participants have nominated as examples of well managed fisheries are characterised by significant inputs of research into resource management plans and close communication between scientists and fishermen. Of all Commonwealth commercial fisheries, the Northern Prawn stands out for the close communication between scientists and industry.

On the other hand, users of research findings (particularly managers) need to be able to understand and interpret what the scientists are saying. This requires that managers have sufficient formal training in the relevant disciplines or, preferably, a sound training in fisheries science (a discipline which integrates biological and economic science and other related disciplines). Few people with such training are employed in Commonwealth fisheries management. The root of the problem is partly one of inadequate provision of appropriate educational courses, and partly the institutional framework of fisheries management.

**Setting research priorities**

At present there is no single decision maker who can allocate research resources and determine priorities.

The setting of research priorities and selection of projects is undertaken by research institutions such as CSIRO. Even where research resources are dedicated to fisheries management issues, as with FIRDC's funding, the usual situation is for research institutions to design research projects according to their particular interests. FIRDC has to choose between projects which do not necessarily reflect the priorities which fisheries managers would set. AFS has had little money to commission research. Its main research resources are used to address urgent problems. The ideal situation is one in which long term research priorities are set and pursued; that is, research should be proactive rather than reactive. However, there is a danger that in striving for a proactive approach this could lead to an excessively rigid priority-setting framework. Therefore, there must be a balance between the two approaches.

While commercial fishermen have had some influence in setting research priorities - and are likely to have a greater say under the new arrangements, recreational fishermen and other users have had very little say about research priority setting. For example, the Australian Fishing Tackle Association (AFTA-NSW) complained:

> Large amounts of money have already been spent by the Commonwealth Government on research and management of yellowfin tuna, and it is apparent that further large amounts will continue to be spent on this species... little if any funding will be spent by the Commonwealth in the immediate future on the other species now under Commonwealth control which are especially targeted by recreational fisheries - in particular the billfishes (marlins, sailfish and spearfish).

*Using a cost-benefit framework*

Given the limited resources available for fisheries research, a priority-ranking system, whereby research projects or programs are ranked in order of expected net benefits, is increasingly seen as being of greater importance. The external review of the CSIRO Division of Fisheries, drew attention to the importance of the Division committing itself to the strategic planning and management process. A key element of this process is to identify the beneficiaries of research programs and also to identify the costs and benefits. Scientists within the Division have expressed interest in implementing project evaluation programs, while ABARE has indicated it has been active in developing an appropriate framework for the evaluation and ranking of research projects.

Within the fisheries research context, the project evaluation process has a number of functions: to ensure that the benefits of undertaking the project are greater than the costs; to set priorities in order of highest net benefits; to make project evaluation more rigourous and transparent; and to ensure that scientists become more accountable to the managers.

*Research emphasis*

The *Review of the CSIRO Division of Fisheries* (CSIRO 1990, p. 2) recommended that:

> The level of effort within the Division, at least for the next five years, should be within the following broad guidelines:
>
> - about two thirds on stock assessment research, including an understanding of factors influencing variations in, and forecasts of, stock abundance;
> - about one quarter on environmental research relevant to fisheries;
> - the remainder on aquaculture.

Industry has also indicated that it wants stock assessment to be a priority of fisheries research. In the Southern Shark fishery, for example, a major debate over the correctness of effort control measures, and the state of the fishery, centres around the validity of stock size used in the SHARKSIM computer model of the fishery and not on the need for such research (refer to Appendix G for details).

There is little *prima facie* evidence of a disproportionate concentration on pure as opposed to applied research. Fisheries research can be classified into three categories (Harden Jones 1989) - pure or basic, tactical applied and strategic applied. Basic or pure research is undertaken to further understanding generally and may not have any direct practical use for managers, fishermen and other users. Tactical research is that which can be applied to the management of the fishery directly, such as stock assessment, while strategic research is not of direct use in management. However, strategic research is required to support tactical, and these categories are largely interdependent.

As an example of this dependence, stock assessment will often require the support of strategic research such as the study of marine habitats and environmental changes. Thus the balance between the resources allocated to tactical and strategic research will vary between fisheries. Where there is already a high level of knowledge about a particular species or its environment the allocation of resources to strategic research can be low. Conversely (Harden Jones 1989, p. 3):

> In the fields ... where knowledge and understanding are still limited, the allocation of resources to strategic research should be high, perhaps not less than 80 % of the total available.

### Timing of research in resource management

Stock assessment is essential for effective resource management. However, assessing fish stocks requires a great deal of resources, including time. The *Review of the CSIRO Division of Fisheries* (CSIRO 1990, p. 15) comments:

> There is, at times, a misconception that some stock assessment is purely of a routine nature which should not be included in the category of fisheries research. This is not so. An understanding of the stock size is one of major outcomes of the research in fish stock population dynamics involving an array of studies on recruitment, growth and mortality within the context of a sound understanding of population dynamics.

Ideally this information (complemented with economic research findings) should form the basis of the management plan for a fishery. However, the Fisheries Division of CSIRO has submitted that the Northern Prawn fishery:

> ... is perhaps the only Commonwealth managed fishery where both scientific and commercial data have been examined together to determine an appropriate management strategy for the fishery. This has resulted in recommendations for a major restructuring, and regulations for the industry which maximise economic returns from the resource without threatening the resource base, and also allowing for a dynamic tracking of the relative abundance of the resource from year to year. This is probably the only fishery in which such a management regime applies.

This example illustrates that resource management in both its broad and narrow sense (in a fishery where there are not presently major conflicting resource demands) is possible if good science is done, if it is integrated with economic analysis, if the findings and implications are communicated to fishermen, and if appropriate management decisions follow. This suggests that, notwithstanding an institutional framework which makes such outcomes very difficult, good intentions and dedicated staff can prevail. It would, of course, be preferable to put in place a framework which would guarantee these outcomes.

The *Review of the CSIRO Division of Fisheries* (CSIRO 1990, p.ÿ15) noted that accurate stock assessment is not yet possible for most fisheries. In the past, fisheries management plans have been based on incomplete knowledge of stock size, optimal offtake rates and environmental influences on these. Determination of the sustainability has been ad hoc, based on incomplete or poor information of the stocks, and determined only as the fishery became over-exploited. In some cases it is doubtful whether a scientific approach was taken in determining the optimal fish down rates or sustainability.

Unfortunately, there is some evidence that the Commonwealth is still allowing the development of new fisheries without sufficient research. In the Northern Territory, the Department of Primary Industry and Fisheries submitted that the Commonwealth has issued rights for a commercial take of high value reef fish without undertaking research into stock assessment nor sustainable yields of the fishery.

This has also been apparent in the Southern Shark fishery. On-going unpublished research by the South Australian and Victorian State fisheries agencies was not used in resource management decisions. State and industry divisions meant that consensus could not be achieved and AFS was not prepared to make tough unilateral decisions. It has now been recognised that the fishery has been dangerously over-exploited. The State research led the Southern Shark Task Force initially to recommend a closure of the fishery for three months, but industry pressure and questions about the research have led to postponement of changes to the management plan (refer to Appendix G).

In the debate, research has become the `pawn in the game'. Those who do not accept that the fishery should be closed or effort drastically reduced have attempted to discredit the research. Others who wish to postpone such management decisions have called for yet more research `to reduce the uncertainty'.

Unfortunately, the timing of research and the use of it to take the best informed but `tough' decisions are problems which have not been adequately addressed. Despite the high cost of scientific research in fisheries, the Australian community does not appear to be getting full value for its money through better resource management. Management's failure to prevent a decline in fisheries is partly a result of the lack of coordination of the various agencies involved in research and regulation. Furthermore, AFS may not have been adequately equipped to interpret scientific information. In future, far greater weight should be given to the scientific input into management.

### Integrating economic and biological research

Allocation of the resource between uses requires integration of biological and economic analysis and the formulation of management actions to achieve sustainable and profitable commercial fisheries. As stated previously, these are the roles for resource management. Essential activities include the valuation of the various uses and establishing the sustainability conditions.

Participants have submitted that management has failed to ensure that the correct level of economic research, and integration with biological research, is undertaken. Dr Young of the CSIRO Division of Fisheries stated that:

> This type of research has usually been carried out by ABARE or within the economics departments of some Australian Universities. Although CSIRO has recently appointed resource economists to some of the Divisions, the Division of Fisheries has yet to appoint anyone with major skills in this area. This has resulted in the main, in inadequate linkage of economic models to modern ecosystem dynamics models.

Notwithstanding the progress that has been made over the years in developing bio-economic models, they are generally too simple in formulation to account for variability between fisheries, the different biological characteristics of species, the natural fluctuations in catch and the vagaries of markets. Managers are forced to make decisions based on these simple models.

### How much research is appropriate?

Fishery research is certainly expensive, and governments have been paying for it with relatively little contribution from commercial users of fisheries. While resources for research are limited, the poor state of many fisheries means that even more research is required. BRR submitted that the level of knowledge about most of the species in the South East Trawl fishery is insufficient to set TACs with a high degree of confidence and that a substantial increase in research funding is required.

BRR submitted that the appropriate level of research should be in line with the prime objectives of research. This was identified to be '... to provide relatively precise estimates of sustainable yield for all the major Commonwealth fisheries'. The degree of precision is an important consideration and there needs to be a trade off between precision and cost.

How much research is required, and how much should be spent, will differ from fishery to fishery. With regard to the Northern Prawn fishery, DrÿBurkeÿHill, Assistant Chief, Division of Fisheries, CSIRO, stated:

> You could certainly get by with a lot less research in the Northern Prawn Fishery if you were doing it purely for the benefit of the Northern Prawn Fishery. You could not get by with much less if you were trying to find out ... more about prawns.

With regard to developing fisheries, Mr Rogers, of the Western Australian Fisheries Department stated:

> ... when the fisheries are initially being developed you have to do substantial research and the industry cannot fund it and that research has to be done.

To underpin successful management in the South East Trawl fishery, BRR has estimated that over $20 million might have to be spent on research over the next 5 years, although considerably less expenditure would be needed to undertake surveys to estimate the biomass. Dr Reichelt submitted:

> If only fish stock assessment is considered and all other fisheries research is ignored (eg. no aquaculture or post-harvest work), an appropriate objective might be to provide relatively precise estimates of sustainable yield for all the major Commonwealth fisheries....For the South East Trawl fishery alone this would be an extremely ambitious objective and may cost in excess of $20 million, in addition to the resources already projected for such work through organisation such as CSIRO and BRR.

Research which is oriented to calculating sustainable TACs (which will form the basis of improved management) must be considered as an investment decision, and therefore evaluated as any other investment would be. If there is a need *now* for substantial research expenditure, as appears to be the case in the South East Trawl fishery and possibly other Commonwealth fisheries, fishermen could, and should, not be expected to pay when the expenditure is incurred, just as they do not expect to recoup immediately the capital investment in boats. Nevertheless, the research should be undertaken if the present value of benefits exceed the present value of costs. (The theoretical framework for the evaluation of research investments has been discussed in some detail in Chapter 2.)

## 5.3 Plans of management

The Commonwealth's chequered history of management of individual fisheries summarised previously, has been mirrored in the various activities required for the development, implementation and review of management plans. This section looks at the development of plans, the controls on catching, monitoring, surveillance and enforcement and restructuring of the fishing industry.

### Controlling catches

As a general rule, management of a fishery has come too late, when the effects of open access have put pressure on fish stocks and led to over-capitalisation. Except for new (undeveloped or exploratory) fisheries, the first task of management is to remedy these problems. In practice it has proved to be a difficult and very slow process, and the most appropriate measures are not necessarily the ones used. Notwithstanding the fact that - certainly until the recent past - management has come in response to calls from fishermen for such measures, there are enormous difficulties in the early stage of getting agreement from fishermen for the appropriate response. This is understandable given that this response is likely to require some fishermen to leave the fishery or use effort-reducing gear. For fishermen, financial considerations will be paramount and the distributional consequences will also be of major concern to them. A 'soft option' management response is also understandable, but there are now enough examples of this leading to even more difficult problems that both managers and fishermen should recognise the folly of 'soft options'.

The slowness with which regulations have been applied, application of inappropriate controls and opting for the 'soft options' have been a major contributor to stock decline, depleted fisheries or continued over-capitalisation. In addition to the factors just mentioned, the same factors which serve to inhibit the initiation of appropriate research and acceptance of research results are also at work to inhibit the introduction of effective and timely regulations. Russell Reichelt submitted:

> Although a number of Commonwealth-managed stocks are now severely depleted, it is not axiomatic that past research advice has been inadequate. In some cases, the work may have been ineffective but it must be noted that instituting reductions in fishing effort is extraordinarily difficult. The fishing industry is unwilling to reduce its gross value of production unless the scientific evidence is extremely compelling.

Fishermen operating in a fishery prefer to limit further entry and even to reduce TACs as long as this is not too drastic. However where the impact of effort reduction is likely to be severe, it is fishermen who are generally responsible for management adopting the 'soft option'.

For example, in the South East Trawl fishery fishermen were well aware of the need for timely management decisions. NIFIC said:

> ... there was a lack of recognition of the change that was taking place or a very slow process to come to grips with the consequences of the changes that were taking place. So in a way the management plans themselves became obstruction to change ... in south east trawl terms, ... it is a long time since it should have been reviewed in a much more detailed manner.

Regarding the 'collapse' of the Southern Shark fishery, the South East Professional Fishermen's Association (SEPFA-SA) submitted that the process of regulation had been too slow to deal with the changing status of the stocks and the fishery generally:

> In having continued to issue $20 Commonwealth licences against State advice even before the shark plan was put in place by the Commonwealth, the Commonwealth must bear the primary responsibility for the deterioration of the shark industry. As we are now seeing, all the Commonwealth's actions have been too little too late. The demise of the shark industry will put greater pressure on the rock lobster industry.

It should be noted that part of the cause of the problems referred to here was the time it took to reach an OCS agreement. The regulations introduced with the implementation of the Plan of Management for the Southern Shark fishery (April 1988) aimed at a 30 per cent effort reduction, but did not take into account the time period over which this should be achieved. Since the announcement by the Southern Shark Task Force of the need to take immediate action in the fishery, in September 1984, effort consistently increased until the 'long term' Management Plan came into effect in April 1988 (refer to Appendix G). Over the next three years, effort was reduced by 27 per cent. During this adjustment period the fishery had deteriorated further and the 30 per cent reduction was no longer appropriate.

A joint submission by the Northern Fishing Companies Association Ltd, Northern Prawn Fishery (Qld) Trawl Association, Northern Territory Trawler Owners Association and Western Australian Northern Trawler Owners Association, submitted that the introduction of regulations was too late:

> As early as 1968 industry warned of the Northern Prawn fishery fleet growing too rapidly, without control, resulting in over-capitalisation and inefficient fishing operations. Despite the warning trawler numbers continued to grow, the managers (Commonwealth and State governments) eventually placing a freeze on the entry of more trawlers in 1977 when the number of entitlements to operate in the fishery reached 272.

The 'soft option' is often adopted in regulations designed to rationalise the industry. The same group of associations:

> Despite the freeze, the number of entitlements continued to increase totalling 292 in 1980. This was the result of the government's liberal entitlement criteria.

Nevertheless, it should be noted that certain sections of the industry desired liberal criteria. Where effort reduction would impose a high cost to-day on the industry or where a fishery is close to collapse, fishermen are instrumental in applying pressure on managers not to reduce the TAC or the number of boats. In the orange roughy fishery, there is a danger that the same mistakes will be repeated. The fishery is at the critical stage where fishing effort must be drastically reduced to a harvest level equal to or somewhat less than the maximum sustainable yield. Currently there is some uncertainty about what this level is and whether the end of the fish-down phase has been reached. Management is under pressure to be selective with the scientific evidence. Many fishermen in the South East Trawl fishery are calling on the managers not to reduce their TACs. Investment commitments mean that fishermen prefer to take the higher risk option and continue to harvest orange roughy at the higher TAC.

It would appear that as a general rule the 'soft option' has been preferred in setting the TAC, despite New Directions (Commonwealth of Australia 1989, p. 41) expounding that a 'conservative approach' should be adopted. When management has been provided with a range for the sustainable yield, the higher figure has usually been adopted.

Faced with a range of options, fisheries managers can justify taking the high risk or 'soft option' by applying the concept of the 'global optimum'. BRR submitted that:

> ... closure of the southern shark fishery would result in the most rapid stock recovery. However, complete closure would also lead to drastic changes in the fishing fleet, in the markets and the processing sectors. Therefore managers seek to balance the effects of catch reductions on the stock against these other issues to find some 'global optimum' in this complex set of interrelated factors.

It is possible that a global optimum could be justified on economic efficiency grounds, but to do so would require a comprehensive analysis of the aggregate net effects on the catching sector and the associated sectors. There is no evidence that such quantification has been undertaken in the past to assist decision-makers. The cost of adopting the 'soft option' is the risk of irreversible damage to stocks. The tendency has generally been one of risk-taking by both managers and fishermen. This tendency has most likely contributed significantly to the depletion of many Commonwealth fisheries.

Lack of coordination of State and Commonwealth fisheries can also contribute to a failure of regulations. An example of this is the Southern Shark fishery, where a net reduction program instituted in the Commonwealth fishery was not instituted in the State fisheries, resulting in the transfer of fishing effort to the State fisheries. In this case, regulations designed to limit effort and protect stocks failed to do so until cooperation with the States was established.

Coordination problems still occur. The Northern Territory Department of Primary Industry and Fisheries submitted that:

> Overlaps in jurisdictions created by OCS cause many difficulties, with some of the implications only now being noticed as we move towards management plans for our own offshore fisheries; eg Northern Prawn fishery vessels may retain a by-catch of bugs, finfish, shark and scallops, which are all species under the control of the Territory.
>
> ... for a number of years there has been developing a small high value reef fishery based on red emperor, red snapper and gold band snapper.
>
> In 1990 the Commonwealth issued a limited number of fish trawl licences to target the same species with no research information and no real consideration on its interaction with the trap and dropline fisheries.

**Monitoring**

The usual form of monitoring the biological and economic health of a fishery - and the success or otherwise of a management plan in achieving its goals - is through a logbook program. On the basis of this flow of information, management can be amended and/or new research commissioned. Obviously, the data collected have to be as accurate as possible.

Participants expressed strong concerns regarding the quality and availability of fisheries data. These concerns are grouped into three categories.

(i) catch and effort data collected through the logbook programs (p 10);

CSIRO, Division of Fisheries, submitted that:

> ... [the log book information] does not contain economic data and there is no regular comprehensive assessment of its validity, nor of its utility for assessment purposes.

The South Australian Shark Fishermen's Association argued that:

> Catch Per Unit Effort cannot be used as an indication of the biomass, because of the false returns submitted as a means of securing an authority [future fishing rights].

(ii) availability of data;

CSIRO, Division of Fisheries, observed further that:

> There are no national fishery statistics. The logbook data ... does not include non Commonwealth controlled fisheries, even if they catch the same stock and species as in adjacent Commonwealth fisheries, eg.. blue eye trevalla is caught by the State managed dropline fishery in S.E. Australia, the same stocks are fished by Commonwealth managed trawlers in the South East Trawl fishery.

(iii) quality of data and analysis;

CSIRO continued:

> The annual analysis of both sets of data [Commonwealth and State] is inadequate. In only a bare minimum of fisheries is there sufficient data to [do] anything more than the most superficial analysis, and in most there is little basis for any form of scientific assessment.

Mr McCormack, of the Victorian Department of Conservation and Environment, mentioned:

> There is a temptation ... and I believe it has happened - for fishermen to ... leave out bits of information, adjust or modify information, to create the impression that they think will be to their best advantage. In the case of declining fisheries ... there must be a temptation for fishermen to try and present a situation that the fishery is in a better condition than it is ...

It is clear that there are some shortcomings with the current system. The accuracy of data must be questioned - particularly given the fact that fishermen say it is an issue. Analysis and distribution of fishery data are slow and in some cases incomplete. It is therefore important that ways be found to improve the quality of logbook data, increase the level of validation and ensure that it reflects the totality of catch and effort pertaining to the species being assessed regardless of jurisdictional boundaries.

Dr Burke Hill, an assistant chief with the Division of Fisheries of CSIRO, has stated that deliberately misleading information in logbooks is becoming less of a problem for two reasons. The first is that confidentiality of information has been guaranteed. Secondly, scientists have enough information to be able to pick up inconsistencies in reported catches. Dr Hill identified the main problem facing the logbook program:

> ...our main difficulty is that the users of the information are not the people who are processing the log-book. AFS has never been a great user of the information; they have not had an interest in making sure that the data that comes out is accurate and so they do not have the same dedication. They are also caught up with this terrible Canberra thing of people moving around; they do not have continuity in terms of their staff and so they have practical problems.

Dr Hill stated that entrusting the log-book program to private interests, through tendering of these functions (as has been suggested by some fishermen), may result in problems. Primarily, ensuring confidentiality is likely to be conceived as a problem by those filling in the log-books. The collection of log-books is also an opportunity to maintain public relations and partially fulfils an extension role; this function may be diminished if private operators undertake the collection of log-books.

There is a trade-off between the quantity and frequency of log-book information collected and the cost of collection and processing. Dr Hill indicated to the Commission that the log-book program can be reduced according to the level of base-knowledge regarding specific fisheries. For example in the Northern Prawn fishery, where the level of knowledge is relatively complete, a much reduced log-book program is required. However, in the South East Trawl fishery, a more extensive logbook program would be required for a longer period of time.

There are other opportunities for cost reductions. It was indicated that it was not always necessary to obtain log-book information from every fishermen and that a sample of fishermen would suffice. In Western Australia, detailed catch information is collected from only about a third of fishermen. The desired objective is to weed out the less motivated and therefore less reliable contributors to the data collection system. The system requires less resources and is therefore cheaper, while presumably providing better information.

**Surveillance and Enforcement**

Surveillance in the AFZ can be divided into the protection of the nation from foreign incursions, including poachers, and surveillance of licensed domestic and foreign fishermen under management plans. It is this latter aspect of surveillance and enforcement, rather than the defence of the nation surveillance undertaken by agencies such as Coastwatch, that is of interest in this inquiry.

Surveillance of licensed foreign fishermen involves on-shore checks before and after fishing trips and occasional checks at sea by naval patrol boats through the Coastwatch program. Observers also perform some surveillance functions, although they are primarily involved in log book verification and collection of other information on fishing activities.

Licensed foreign boats are required to report (by radio) their location every day while in the AFZ. These reports are transmitted to AMSA and passed on to AFS.

Surveillance of domestic fishermen is directed at keeping out poachers and ensuring that those who are entitled to fish comply with the management regulations. This is generally undertaken by State agencies on behalf of the Commonwealth.

In recent years surveillance of domestic fisheries operations has been included in some fisheries management plans, resulting in a higher level of consultation between fisheries managers and industry. AFS acknowledged that in some cases this has led to managers developing more cost-effective surveillance arrangements, bringing about substantial cost reductions, but (Commonwealth of Australia 1989, p. 63):

> In other fisheries, however, fishermen have demanded unrealistic reductions in surveillance activity - reductions which would, in the view of managers, threaten the viability of the whole management structure.

When there is pressure from industry to cut costs, surveillance was seen as an easy activity to cut. Mr McLaughlan, Director of Operations, Western Australian Fisheries Department, stated:

> I think we have already had the experience of that in the tuna fishery where the industry's perception of what is needed to oversee quota management is well below what I would see as being necessary ... and I believe that it is already demonstrated that there has been some major blow-outs in quota management ... as a direct result of inadequate resources.

It is possible that surveillance costs will decrease in the future, as Dr Burke Hill, Assistant Chief, Division of Fisheries, CSIRO states:

> I think in the not too distant future we will see satellite based recording of ships' positions at sea and that will save a lot of surveillance costs ...

Mr McCormack, Acting Director, Fisheries Management Division, Victorian Department of Conservation and Environment, stated there was an opportunity to reduce surveillance costs by having fishermen adopt a Code of Practice:

> ... there is clearly an opportunity for some self-regulation along the lines perhaps of a code of practice.

**Restructuring**

Once the level of exploitation of a fishery is determined, the optimal level of capital required to harvest it and maximise returns must be determined. Determining the optimal level of capitalisation in a fishery and, if need be, reducing the level of capitalisation is of direct benefit to fishermen.

A number of measures have been adopted in recent years to reduce excess capacity in Commonwealth fisheries. These are the buy-back arrangements in the Northern Prawn fishery, net amalgamation in the Southern Shark fishery and ITQs in the Southern Bluefin Tuna and the South East Trawl fisheries. The purpose of these arrangements is to increase the profitability of operators who remain in the fisheries. The Government has also established a task force to examine further structural adjustment measures.

There are three very important factors which have a bearing on how rationalisation occurs in a fishery and the speed by which it occurs. One is the nature of the access right held by fishermen. In Commonwealth fisheries this means either ITQs or limited entry rights pertaining to boats and/or gear. The second is the duration of the right and whether or not they are transferable. Obviously with ITQs they are transferable. For limited entry fisheries the rights can be either transferable or non-transferable. The third pertains to the rules applied to boat/gear replacement.

In fisheries which are regulated by an ITQ system, rationalisation occurs automatically and continuously, through trade of individual quotas. If there is no alternative use for boats in an over-capitalised fishery (in economic terms, their opportunity cost is zero or close to it), one of two outcomes is likely. Either fishermen will not sell quota and remain fishing as long as they can cover their running (variable) costs or the offer price for quotas will reflect both a quota price and a value attached to the boat.

In fisheries which are regulated by input controls (such as limited entry for boats and/or gear) and transfer of rights is permissible, rationalisation will occur by buy-back of rights. It is possible for this to occur without intervention by the regulators, that is, voluntary buy-back is a possibility. Again if there is no alternative use for boats/gear which might be expected to leave the fishery, buy-back will either not occur or be very slow and the offer price for rights will include a value for the boat/gear.

There is a third situation in which access rights are not transferable. In this case rationalisation will occur, probably very slowly, as boats/gear eventually wear out or as fishermen become too old to fish. Boat/gear replacement rules will have a major bearing on the rate at which final exit from such a fishery occurs.

Rationalisation of an over-capitalised fishery will benefit fishermen. Fishermen will only leave a fishery if by doing so they are better off or at least no worse off. This principle will determine their offer price for ITQs or buy-back. Fishermen will only purchase ITQs or limited entry rights if as a consequence of the effort reduction there is an expectation of greater profits for them. In theory the increased profit need not be large; it would need to provide the same, or marginally better, rate of return as they would get on an alternative investment.

It is via these market calculations that the fishing industry can adjust itself, although it is not necessarily this simple. There can be a tendency for expected profit increases (management rents) to be capitalised in the value of rights. That is, those fishermen who contemplate selling their access rights will correctly assume that those fishermen who purchase the rights and remain in the fishery will be better off and therefore will be willing to pay a sum which is the capitalised value of these rights. Once rationalisation is mooted by government - and it is usually done after an economic analysis of the benefits has been prepared and publicly released by ABARE - this process of capitalising expected new profits occurs. There is also a tendency by those contemplating sale of their rights, particularly through a buy-back scheme, to engage in strategic behaviour, holding out indefinitely for a higher price.

A further issue which is likely to affect rationalisation schemes is the Commonwealth's stated policy of taxing new resource rents (profits) which result. There are two matters to be considered in this regard. The first is that it is possible that as a consequence of capitalisation of expected new profits the fishermen who buy additional rights are not going to earn anything other than marginally increased profits. Very little, if anything, in new rents will result. The second is that fishermen who aim to remain fishing will consider the net effect (the additional returns after the resource rent tax has been deducted) in calculating a value for the access rights they would wish to purchase.

Obviously rationalisation is much easier in fisheries managed by ITQs. The experience in limited entry fisheries suggests that government intervention is necessary to overcome the strategic behaviour of fishermen. This is illustrated by the example of the on-going buy-back scheme for the Northern Prawn fishery (see AppendixÿK for a more detailed discussion).

The original voluntary buy-back scheme introduced in 1985 had only a limited impact on fishing capacity. Many of the units bought were for boats that were either not active in the fishery or were less efficient. In the current scheme introduced in early 1991 operators were given a financial inducement to sell their units prior to the 1990 season. Under that arrangement 40 boats left the fishery. Furthermore, if the target of 50 000 units is not reached by 13 December 1992, there will be a compulsory reduction of units across all unit holders in the fishery.

Under the current buy-back scheme the Commonwealth Government has provided a $5 million grant and underwritten the $40 million financing of the scheme. The loan is to be paid back by a levy on fishermen who remain in the fishery.

According to *New Directions*, such adjustment assistance is justified because the Commonwealth should receive some of the benefits of increased profitability through a tax on the resource rent generated through adjustment. Nevertheless, it would appear that to some extent the benefits of adjustment have been capitalised through a dramatic increase in the market value of fishing rights. Between 1985 and 1989, the buy-back induced a five-fold increase in the value of fishing rights. The inducement to leave the fishery may need to be quite considerable given the low opportunity cost of the labour and capital involved.

The buy back is still about 50 boats short of its target for 13 December 1992. For most fishermen the considerable bonus for leaving before the 1991 season was less attractive than the promise of a good catch. About half the 40 boats that left the fishery prior to the 1991 season belonged to operators who were in receivership and would have left the industry anyway. The announcement by AFS that they were investigating the possibility of introducing ITQs into the fishery may also have discouraged exit from the industry. Such an announcement is likely to be taken as a signal that the compulsory buy-back scheme may not proceed. The possible introduction of ITQs into the fishery may be seen by some fishermen as an opportunity to cash their access rights for a higher price some time in the future.

As an input controlled fishery the Northern Prawn fishery is likely to become overcapitalised once again. The effectiveness of reductions based on boat length and engine size or any other input control is limited to the extent that effort or fishing capacity can still expand through increased fishing hours and the adoption of more technically efficient equipment. This means that sometime in the future additional buy-backs are likely to be required.

In 1988 a net amalgamation program was introduced into the Southern Shark fishery. A fisherman was permitted to change his 6 net endorsement to a 10 net one by purchasing a 6 net endorsement and forfeiting two of these. On average each fisherman invested about $120ÿ000 to upgrade in this way. The program fell well short of its aim of reducing effort by 30 per cent. Furthermore, during the life of the program, the state of the fishery worsened requiring even further reductions than were originally envisaged. The program has also been criticised because fishermen increased their fishing hours in order to pay the cost of the amalgamation and because it did not take account of the scope for increased catching capacity from a given number of nets through improved technology.

Rationalisation of the ITQ-controlled Southern Bluefin Tuna fishery should not have encountered problems of the type discussed above. ITQs were introduced into the Southern Bluefin Tuna fishery in 1984. ITQs allow the industry to freely choose the most efficient means of harvesting the TAC, including the appropriate number of boats. Fishermen were granted a quota entitlement to a proportion of the TAC based on past involvement in the fishery. The more efficient fishermen were then able to buy out the less efficient or those who simply wanted to leave the fishery. Considerable trading in ITQs took place 1984 and 1985. Australian boat numbers have fallen from 10 in 1989 to about 7 in 1991. This was to some extent due to the transfer of rights to Japanese boats and the reduced TAC.

A major problem with the introduction of ITQs in the Southern Bluefin Tuna fishery was that the TAC was set too high. Australian fishermen who had bought quota on the basis of the initial TAC were financially penalised. Those who sold in the earlier period obtained a price which they would not get now with the much lower quota.

As a general rule it would seem that fishermen have not been sufficiently risk averse in bidding for quota, and they obviously preferred the higher TAC which the managers set. In retrospect, probably all except those who were fortunate to sell quota based on prices which reflected an expectation of an unsustainably high TAC have suffered.

A problem that is common to the adjustment programs in a specific fishery is that they can have adverse effects on other fisheries. Fishermen who have been `adjusted out' of one fishery may simply increase fishing effort in some other fishery in which they have an endorsement to fish. This is referred to as `licence splitting'. Some of the initial success of the rationalisation of the Southern Bluefin Tuna fishery that followed the introduction of ITQs depended on the fact that fishermen were able to shift their operations to other fisheries. Rationalisation was occurring

during a period of expansion of effort in the South East Trawl fishery. A number of fishermen operating in the Southern Bluefin Tuna fishery had access rights to the South East Trawl fishery, and in fact fished in both fisheries. The financial gains they obtained from the sale of ITQs presented them with the wherewithal to increase effort in the South East Trawl fishery (see Appendix G for details).

To some extent, in some fisheries, the over-capitalisation that adjustment programs endeavour to rectify was the perverse result of a limited entry management regime that had previously been introduced to prevent further increases in fishing effort or capacity. The problem here is the criteria set for gaining access rights to a limited entry fishery.

Usually catch history and past investment are the criteria for determining one's entitlement to fish. Because limited entry was foreshadowed before it actually occurred, fishermen increased their fishing effort and investment in order to 'stake a claim'.

Other failings in limited entry, while not actively encouraging over-capitalisation, left loopholes for increased capacity. Excessively liberal boat replacement policies enabled fishermen to replace old boats with boats of greater fishing capacity. Limited entry only restricts some inputs and not others. For example, it does not restrict the number of hours a fisherman operates or specific details of the technology employed. In this way fishermen can still, to some extent, increase fishing capacity. Furthermore, the increase in capacity would tend to be less efficient than if it was based on an unconstrained choice of inputs.

Because of the advantages of adjusting a fishery by the allocation of ITQs, the Commonwealth has announced that it intends to phase in ITQs for the major species in the South East Trawl fishery during 1991 and 1992. The main problem is that for most species the current biological knowledge is insufficient to allow for the setting of optimal long term TACs. Given the extreme vulnerability of many of the fish stocks, a TAC that is too high will quickly lead to a stock 'collapse', in which case any capacity adjustment will have been in vain.

An example of the problem is illustrated by what happened to gemfish. Proportional ITQs have been introduced for gemfish in the South East Trawl fishery. When they were first introduced in 1988, the TAC was 3000 tonnes. In 1990 this was reduced to 1750 tonnes on scientific advice and in 1991 reduced further to 420 tonnes.

Notwithstanding the warning issued by AFS representative, Mr Bernie Scott, that fishermen should be risk averse in making individual decisions in the purchase of individual quotas or other types of access rights in the South East Trawl fishery, there is the possibility that they will be over-optimistic. Before ITQs are introduced for other species it is essential that scientists fully inform fishermen of the status of the stocks and what the long term sustainable yields are likely to be, and that managers take a conservative approach in setting TACs.

Limitations on fishing right amalgamations such as the 'one person one right' policy in South Australia may in some cases inhibit adjustment to more efficient industry structures and improved financial strength for the fishing industry. Such policies lead to increased fishing effort in individual fisheries. In diversified fisheries, fishing effort is spread over a number of fisheries. Fishermen adapt to seasonal variations in fish abundance and are able to reduce effort in a fishery during a seasonal decline and move to another fishery to supplement their income.

**Summary**

The experience with restructuring Commonwealth fisheries is limited. The major work in this regard is still to be done. How restructuring is achieved in the future will depend on the type of management regime imposed on particular fisheries.

If it is possible to impose ITQ management regimes on fisheries presently not subject to this type of management, restructuring will be automatic. It will occur naturally through the market transactions of quota holders. Operators in the fishery will make their own decisions on exiting, entering or expanding their investment. There will be no need for Government involvement to facilitate this. Government will be limited to the administrative tasks of recording entitlements and the ongoing policing of catches. Clearly, restructuring under ITQ management is industry management. It is not compulsory and industry 'pays' and benefits. The level of capital in the fishery at any point in time is, by definition, optimal. That is, the MEY level of effort is determined by fishermen valuing their boats, labour and entitlements at their opportunity costs and estimating the expected profits to be gained by remaining in (or entering) the fishery.

A number of factors suggest that ITQ management may not be feasible for some fisheries, certainly at this time. Unless fishermen accept this type of management, it will be difficult to impose and costly in terms of resolving conflicts. The past experiences of drastically reduced TACs is likely to influence fishermen - even though this phenomenon is not a condemnation of ITQs per se but rather the difficulty of setting sustainable TACs. Experience shows that considerable research should be undertaken before setting TACs - and research is costly. It is feasible to introduce an ITQ regime before the desirable amount of research is done by setting conservative TACs, and trading-off the possibility of forgone catches if the TAC is proven to be too low against the costs of research. Where there is a high degree of uncertainty as to the robustness of a TAC, fishermen must be warned in the strongest possible way that there are high risks involved in investing in quota. They must be informed that the risks are theirs and the managers and scientists are not to be blamed if the TAC has to be changed. This is to put responsibility where it belongs in a world of uncertainty.

Other issues which are likely to influence managers and fishermen are the costs of policing an ITQ system. These costs need to be compared to alternative management regimes. Fishermen need to be made aware of the comparative costs. This is an issue which has not been adequately considered in Australia to date. There are other real and potential problems, including 'high grading' and the economic costs which result and the question of how to incorporate recreational fishermen in an ITQ regime.

As explained previously, restructuring in an input controlled fishery results in an interdependency between resource management and industry management. Voluntary restructuring, through buy-back, is feasible, but the experience with this suggests that the possibility of it occurring is very low. For fishermen to entertain the idea they need to fully understand the nature of over-capitalisation in an open access fishery. It is not clear that all fishermen do. Notwithstanding the effort that fisheries managers and economists have made over the years to inform fishermen, much more needs to be done. Strong and respected leadership in industry groups (an example being the Spencer Gulf prawn fishery) has the potential to facilitate industry-driven restructuring (buy-back) in an input controlled fishery.

For some time yet, the task of rationalising an over-capitalised limited entry fishery is likely to fall on Government. The rationale for imposing buy-back is the economic gains. Who benefits from a more efficient fishery is irrelevant in this context. What is questionable is publicly funded assistance of buy-back. It is neither equitable nor efficient if fishermen in input controlled fisheries obtain assistance (as in the Northern Prawn fishery) and those in ITQ managed fisheries (as in Southern Bluefin Tuna fishery) do not.

There is an important empirical issue which does not appear to have been adequately dealt with in determining the degree of effort reduction required in some fisheries. Not enough consideration and data have been brought to bear in measuring the opportunity costs of boats and labour in an existing fishery. If they have no other - or less profitable - uses elsewhere in the economy, the extent of over-capitalisation is exaggerated.

The impact of past management decisions also has a bearing on the degree of effort reduction required in some Commonwealth fisheries. Too often a new management proposal was announced far in advance of action being taken, leading to a rush of capital into the fishery by both existing and new entrants in anticipation that future access rights will be based on factors such as catch histories and capital invested. Some fishermen blame managements for this situation and go as far as claiming they should be (somehow) compensated when restructuring is required. What this perspective overlooks is that by and large managers were reacting to the demands of industry, or at least parts of it.

## 5.4 Industry-government co-management

The extent to which fishermen are involved in fisheries management varies widely between fisheries. While they have played an important role in the past through interaction with AFS managers and in MACs, and are likely to play a greater role under the new arrangements, this role has, in the main, been confined to the, admittedly, important policy area. A review of this aspect of industry involvement is not presented here, rather attention is given to the example of limited 'self-management' in the South Australian Spencer Gulf fishery. If the lessons of the Spencer Gulf fishery can be applied generally, there is scope for industry - at the fishery level - to play a greater role in doing a number of things collectively which need not concern managers. These are things that are purely industry related and have no impact on the fish stocks overall, and by and large they are unrelated to the means of addressing the open access problem.

They require collective action by industry participants. They are not issues of any past concern by most managers and need not be in the future, except in two ways: the nature of less than full property rights in a fishery will mean that Government will need to ensure that any actions taken on this are consistent with its resource management objectives; Government has a role in enabling this level of industry 'self-management' to occur. For these reasons, this level of management can be termed 'co-management'. It is discussed in more detail in Appendix H. An example of co-management for fishery enhancement is discussed in Appendix K.

The type of matters involved include research aimed at determining the most appropriate time and locations to fish in order to maximise net returns, occupational health and safety, training and extension, post harvest handling, marketing, and the development and trailing of new fishing equipment. It can also include coordination of fishing to ensure that fish are supplied to the market at such times and in such quantities as to maximise returns to fishermen.

Such collective goods can be provided either by government or a cooperative organisation backed by legislation which seeks to mimic the actions of a sole owner of a fishery. An individual or corporate body would then have the incentive to provide management functions which will increase productivity knowing that the benefits will not be dissipated to those who do not pay.

A prominent example of industry provision of industry management is the Spencer Gulf prawn fishery in South Australia. Since 1978, an association of operators, the Spencer Gulf and West Coast Prawn Fishermen's Association (SGWCPA), has adopted a policy of developing management structures based on industry control. It has done this with the approval and guidance of the South Australian Department of Fisheries. The intention is to generate satisfactory (not necessarily maximum) profits for those allowed to operate in the fishery and to do so at minimum management costs. The fishery is operated as a cooperative (or collective) with fairly explicit notions of equity (for operators) underlying the management regime. Overall resource policy directions remain with the South Australian Department: it is the final arbitrator on significant issues; and the Department recovers some of its costs and takes some of the management rents

through the licensing system. The Association has implemented its own initiatives to minimise costs by becoming involved in enforcement, scientific surveys, managerial and administrative services, and the purchase of a telecommunication system for managing the on water movement of vessels.

Characteristics of the fishery which make it conducive to such an extent of 'self-management' include a long history of limited entry; a small fishing ground; the predominant use of Port Lincoln as a common port; a long-term history of involvement by the State Department's scientific research officer; the necessary statutory backing of the Association's collective action by the State Department; the State Department's involvement in overall resource management; and the fact that the fishery is in 'equilibrium' (to the extent that this is possible in any fishery) as stocks are not over-exploited. It should also be noted that the effects of producing too much fishing effort in prawn fisheries is less severe than in other fisheries. This is because, over a wide range, stocks are relatively insensitive to increases in fishing effort.

Given that the benefits of industry management are entirely internal to the industry, the industry should pay for it. For the same reason industry management should, generally speaking, be provided by the industry itself through some form of cooperative organisation. Such an arrangement is likely to ensure that management effectively meets industry needs. It would also ensure cost effectiveness given that industry would have control over costs and the incentive to minimise them.

## 5.5 Marketing

If marketing is not competitive, this will tend to impede the realisation of potential efficiency gains made in the catching sector of the fishing industry. Some fishermen indicated the presence of significant problems in marketing fish and that these problems could potentially be resolved through efforts towards greater industry involvement and competition in the marketing sector.

In Victoria, the Commission was told of collusive practices between large wholesalers. It was alleged that fishermen received lower prices which did not reflect quality differences. Fishermen could not obtain a price premium for quality and this was a disincentive to improved marketing, handling and transport procedures. In New South Wales, some fishermen were dissatisfied with the statutory marketing arrangements administered by the New South Wales Fish Marketing

Authority (FMA). Given that there may be inefficiencies and higher costs in the FMA marketing arrangements, fish imports, which are exempt from these regulations, will face a more favourable market environment. They also said that current marketing arrangements made it difficult to sell a number of lesser known species, resulting in significant waste of fish and reduction in potential revenue at a time when catches of traditional species were being reduced.

The Commission has not been able, in the time available, to investigate these allegations and hence makes no judgement on the state of affairs. Nevertheless, it draws attention to the fact that fisheries management in its broader sense encompasses more than the catching of fish, and if impediments exist in marketing these should be addressed.

## 5.6 Concluding remarks

The overall assessment of management activities can be gauged by the number of fisheries which are sustainable and operating at their maximum economic yield. The evidence suggests that no major Commonwealth fisheries qualify for this category. Fisheries such as the Bass Strait Scallop fishery have collapsed with fishing being confined to monitoring stocks, while other fisheries, such as gemfish in the South East Trawl fishery, and gummy and school shark in the Southern Shark fishery, are experiencing serious declines in the sustainable yield, falling well below their maximum economic yields and, on the scientific evidence, approaching total collapse and closure. In the orange roughy fishery (in the South East Trawl fishery) there is still hope of achieving sustainable yields and, eventually, reasonable profits, if tough decisions to drastically reduce fishing effort are adopted. However, in this fishery there is a high degree of uncertainty and controversy as to whether the fishery has approached the end of its fish-down phase. There is on-going debate as to the long term sustainable yields of tuna. Except for the Northern Prawn fishery, all major Commonwealth fisheries are facing serious problems.

It is clear that greater coordination of management activities, including research, is required in fisheries management. There is a need for a far more integrated approach to fisheries management. Greater efforts need to be undertaken to resolve jurisdictional problems and coordinate regulations between the Commonwealth and States. Many of the past and present problems are a result of a jurisdictional structure based on political boundaries rather than on natural ecosystem boundaries. This requires urgent attention.

The increasing pressure of recreational fishing and societal demands for sustainable uses of the marine environment require that fisheries management become a sub-set of resource management of the AFZ. However, the current institutional framework is ill-equipped to deal with these issues.

# 6 CONCLUSIONS

Who should pay what for fisheries management? This question begs a number of other questions about the objectives and effects of fisheries management, the resources that should be devoted to it, and how it should be undertaken. These questions must be resolved together.

In addressing the terms of reference, the Commission has had to consider which aspects of fisheries management are rightly the responsibility of government and which are the responsibility of users of the marine environment. In undertaking its task the Commission has to consider the nature of the 'fisheries problem' - open access can deplete the fish stock and results in over-capitalisation of commercial fishing fleets. However, rational use of the living marine environment is more than a fisheries problem. It is a 'resource problem' because of the competing demands on the resource, now and in the future. This means that it involves all users of the resource, not just the commercial fishing industry.

The clearer delineation of responsibilities among government agencies and users will help to make management more effective and less expensive than it is currently. Furthermore, since the allocation of responsibility depends on who benefits from each management function, delineation of responsibilities assists in attributing the costs of management and hence in determining who should pay.

## 6.1 The issues in context

The terms of reference require the Commission to consider the question of cost recovery for the management of fisheries under Commonwealth control, determine the major beneficiaries of this management, consider the most suitable points at which cost recovery should be imposed, and report on which beneficiaries should contribute to the costs of management (including the proportion that should be met by the commercial fishing industry and the proportion by Government).

In so doing the Commission is to take account of Australia's international obligations under UNCLOS; the Government's fisheries management objectives; the Government's policy that the beneficiaries of services should contribute to the costs in proportion to the benefits received (subject to it being cost effective to do so); the Government's policy that the full cost of management of foreign fishing be recovered; the Government's policy that it will meet the full cost of surveillance and enforcement of illegal foreign fishing in the AFZ; the special circumstances in the Torres Strait and special circumstances which might apply in other fisheries (which could mean variations in the payment for management); while having regard to the established economic, social and environmental objectives of governments.

The evolving nature of fisheries management means that specific answers to these questions are likely to change over time, although the underlying principles should not. The administration of Commonwealth fisheries is in a transitional phase. At the beginning of the Inquiry the major management responsibility was with the AFS. At the completion of the Inquiry legislation is in place which will transfer that responsibility to AFMA. There are differences between the old and new statutory requirements. The new arrangements explicitly require fisheries management policies to be consistent with the principles of ecologically sustainable development, and to take into account recreational fishing.

The rationalisation of jurisdictional arrangements under the OCS is on-going. New OCS arrangements are likely in the future as there is increasing recognition of problems, in some fisheries at least, resulting from the present arrangements. This aspect of management should also be considered to be in a transitional phase.

Fisheries themselves are in a state of transition. All major Commonwealth managed fisheries are either over-exploited or over-capitalised, or both. The future of the developmental and exploratory fisheries is uncertain. Two major fisheries are in the process of restructuring. The ITQ managed Southern Bluefin Tuna is - as with all ITQ systems - continually restructuring itself, but in an era of falling TACs and uncertainty as to a sustainable TAC. In this fishery there is the additional complexity of resource sharing with foreign fishing nations and this is subject to change periodically. The input controlled Northern Prawn Fishery is being restructured by the imposition of a compulsory buy-back. At the completion of that process (in 1993), the fishery should be left with a level of effort which will produce maximum economic benefits.

Decisions on how to restructure the other major fisheries are still to be made. For example, considerable resources are being devoted to finding solutions to the declining catches and excessive over-capitalisation in the South East Trawl fishery. The scientific advice is that a very substantial and costly research effort will be a prerequisite in determining the optimal level of effort and the appropriate management plan for this fishery. The Southern Shark fishery is beset with drastically falling catches and over-capitalisation. Its future is uncertain.

Given the likely extent of restructuring which will be required to produce economic efficient, sustainable fisheries, the future will be quite different from the present. The duration of this transitional phase is unknown.

There are other considerations in the changing nature of fisheries. Recreational fishing interests are becoming more prominent. While this is not a major direct issue in the majority of Commonwealth managed fisheries (it is in tuna fisheries), the impact of 'inshore' (State managed) recreational fishing on 'offshore' (Commonwealth managed) fishing is starting to be recognised. The result is that greater attention is being paid to resource sharing. Other marine-based recreational activities, such as charter boat fishing and nature appreciation, are of growing significance, again pointing to the need to consider questions of allocation of access if the uses are in conflict.

Fishermen and the fishing industry are changing. In the words of one participant, they are becoming more 'mature'. Fishermen are demanding a greater say in management, and there are examples of fishermen taking collective action to better manage their industry. These changes provide the backdrop against which the central issues in the terms of reference need to be addressed. The main focus of the remainder of the chapter is on three questions:

- who benefits from fisheries management?
- who should pay?
- how should charges be made?

## 6.2 Who benefits from fisheries management?

Chapter 5 has presented an assessment of past management. For a range of reasons (such as the existing institutional structures, jurisdictional splits, insufficient knowledge of stock dynamics, difficulty in getting industry sectors to agree) most of the major Commonwealth managed fisheries are in poor biological and economic shape. By and large resource management has not been effective or cost-efficient.

In terms of the management of the fishing industry itself, the picture is rather mixed. Fishermen who were originally granted access to limited entry fisheries have benefited from that decision of Government. Subsequent entrants who have had to purchase access rights, including ITQs, have not been in this favoured position.

On-going management, such as maintenance of a licensing system, certain biological controls, surveillance and enforcement and monitoring, has benefited those permitted to fish - in as much as without these activities more serious biological problems would have been the likely result. Even if such management controls did no more than hold effort at the open-access level, this is a benefit. A number of fisheries have experienced worsening biological and economic problems, notwithstanding this management. The reasons for this are varied, including setting TACs too high, a rush of capital before 'closing' a fishery and technological developments which have countered the input controls. In this sense, the benefits of the past management actions have been smaller than many would have expected.

For the variety of reasons discussed throughout this report, commercial fishermen in most major Commonwealth fisheries have yet to benefit from restructuring. An exception is the Northern Prawn Fishery. In this fishery, the current buy-back scheme should result in a more profitable fishery. The Government assistance granted to facilitate buy-back is a benefit to industry and is being shared between those exiting and those remaining.

To the extent that recreational fishermen operating in Commonwealth fisheries have benefited, it has been as a consequence of the ongoing management actions taken to manage commercial fishing. That is, any benefits (such as controlling the effort by commercial fishermen) were a by-product. There is one possible exception to this and that is in the East Coast Tuna fishery where some requests made by recreational fishermen - over and above what the commercial industry desired - have been met. The extent of such benefits cannot be measured at present.

Fishing communities benefit from having in their locality a profitable commercial industry and/or a valued recreational fishery; that is, if the profits are spent or invested locally. The nation as a whole benefits from more profitable fisheries and structural change can mean that some communities lose, in terms of local income, while others benefit.

In as much as past management (as described above) has probably had some benefits over and above no management, local communities are marginally better off.

Fish consumers benefit when fisheries management results in higher sustainable catches and this causes the domestic price to fall. For many species, the price in Australia is determined by the world price and domestic demand is very elastic. For those species where demand is responsive to price, consumers will benefit if more fish are supplied or if the same quantity is supplied at a lower price, all other things being equal. One or the other, or both, of these results would result when the fisheries are restructured to operate at their economic efficient level. There is no evidence available to indicate measurable benefits of this kind to consumers from past management.

The wider community benefits from fisheries management in a range of ways, and benefits are likely to change over time. Resource management decisions which result in sustainable commercial and recreational fisheries and protection of other values, such as amenity, benefit the wider community as well as user groups. In this regard management has provided some benefits, resulting from biological controls and decisions to reduce TACs. At this point in time there are no data on which to determine the extent of such benefits.

Fisheries management is costly. Most of that cost has been borne by taxpayers. Only since cost recovery was introduced has the commercial fishing industry paid for a part of that cost. This report has documented the substantial expenditure on fisheries management in recent years. The total cost over the whole period of management, a period which extends far into the past for some fisheries, would be much larger.

It has not been possible to quantify the benefits of fisheries management which have resulted so far. Without any management the biological and economic health of fisheries would probably have been worse. But it is not realistic to attempt to determine what the state of the fisheries would be now had there not been management. Much depends on the biology of the targeted species, the stage in the development phase of the fishery when management was introduced, the form of management and the extent to which biological controls prohibited total collapse or extinction of species.

However, what can be stated with some degree of certainty is that to date management has not produced profitable, sustainable fisheries, which is one of its prime goals. There should have been net benefits to society from management. It is difficult to accept that there have been. What needs to be done now is to learn from the past and put in place management which will produce net benefits in the future.

## 6.3 Who should pay for what?

In this report, the Commission has distinguished resource management and the management of particular users such as the commercial fishing industry as conceptually separate types of activities, directed towards different objectives. The Commission nevertheless recognises that as a consequence of the interdependencies between biological functions of a fish stock and economic activity (fishing) that there is overlap between the two. This is clearly the case with input controlled fisheries (which at present means the majority of Commonwealth fisheries).

To the extent possible the commercial fishing industry should have responsibility for providing those services which benefit industry. The nature of industry management in this sense will differ from fishery to fishery and be largely influenced by the type of management regime in place. For example, in an ITQ managed fishery there is little more for the managers to do than set a TAC, issue quotas, apply biological controls if necessary and monitor catches. Restructuring is left to the industry via market transactions. In an input controlled fishery there is less scope for industry management until the fishery is restructured and operating at an economic efficient level. Nevertheless, there are a number of activities, such as 'real time' management, marketing, etc which are divorced from the wider concerns of management and, therefore, can be undertaken at the fishery level to enhance profitability.

The Commission proposes that responsibility for the provision of fisheries management services which provide largely public goods and services should lie with government. General management of the AFZ, management related to conservation and other ecological objectives, social policy related to traditional fishermen such as those in the Torres Strait, treaty obligations, relations between governments, control of foreign fishing and enforcement of regulations and laws clearly fall into this category.

Resource management is the basis of fisheries management - it is an essential input to all fishery operations. The basic assessment, allocation and protection of fisheries resources must remain a responsibility of government. While the Commonwealth has the ultimate responsibility and duty to *undertake* resource management of the fisheries under its control, those who have been allocated access to, or use of, certain areas or resources in the marine environment make use of marine resources as an input to their production or consumption.

Some types of resource management, such as research, are not neatly categorised as public or private goods; they can provide significant benefits to users as well as to the community, both now and in the future. Efficiency and equity considerations both require that users as well as tax-payers should contribute to the costs of resource management. The question is how much should each contribute. Users should contribute to resource management according to the benefits which they derive from it. All operators in a fishery should contribute towards the cost of managing that fishery, regardless of whether they fish for pleasure or profit, or of the state of profitability of the fishery. Contributions to resource management should be seen as integral costs of fishing, just as are the costs of capital, labour, fuel and gear. Users should also be responsible for the costs of ensuring compliance with the constraints imposed by government for resource management purposes.

The proportions which should be borne by governments and users are likely to change from fishery to fishery and over time. In the exploratory stages, resource management costs are likely to be high, particularly if a major research effort is required to determine the extent of the stock and its dynamics. This is also likely to be the case when a fishery is depleted and the capacity of the fishing industry to pay is also low. For depleted fisheries, the time to recovery for many species of Australian fish is so long that future generations will reap the benefits of today's research while those currently fishing bear the costs of drastic reductions in catches.

At times, the Government will have to make large, lumpy investments in resource management, particularly research. It should have some means of recouping these costs through time, as it would for other investments.

## 6.4 Charging the commercial fishing industry

The industry should bear the incremental costs of fisheries management measures which are implemented because of commercial fishing activities. This means that the industry should pay in full for industry management measures including restructuring and other management costs (such as the costs of surveillance, monitoring, licensing and administration) which are wholly attributable to commercial fishing activities.

The industry should contribute towards the costs of resource management which is associated with its use of the resource. This means the industry should make a more significant contribution towards the costs of research and the development of management plans for individual fisheries. The proposed research and development levy of 0.25 per cent of GVP would bring in $600 000, a rather small amount compared to the $15 million currently spent on research. While it is true that commercial fishing is not the sole beneficiary of this research and that the ultimate benefits (increased, sustained profits) are unlikely to occur until a considerable time in the future, it must be recognised that much of this research is undertaken to enable commercial fishing to be sustained. It is clear that a new approach is warranted.

### Charging for resource management

At present, most of the Commonwealth's established fisheries other than the Northern Prawn fishery are depleted. Both government and the fishing industry bear some responsibility for this sad state of affairs. While the Commission does not seek to lay blame in any particular quarter, it is important that these problems be recognised and addressed.

In many fisheries, rehabilitation of fisheries will require more and better research and more complex resource management as well as marked reductions in catches. This will severely reduce the capacity of the commercial fishing industry to contribute to resource management until the fisheries recover. If the resource management of Commonwealth fisheries is to improve in the long term, the Commonwealth will have to bear the short to medium term costs of the necessary extra research and other elements of resource management. Nevertheless, fishermen will eventually benefit.

This report has shown that it is impossible to attribute accurately the costs of much of the research and other activities required for resource management. While auctions of access rights could provide some market assessment of the value which the industry places on the resource management which is actually being delivered, this is not feasible for all but foreign fishermen, whose fishing rights are reviewed annually. With the passage of new legislation, the Commonwealth Government's policy is to recognise the ongoing nature of existing access rights to domestic fishermen and to tie those rights to the life of management plans.

As previous chapters have argued, much research should be viewed as an investment for the long term sustainability of fisheries. Some large research projects are necessary to more accurately set TACs, particularly in new and depleted fisheries. In the Southeast Trawl fishery alone it has been estimated that research costing over $21 million will be necessary over the next five years to attempt to set reasonably accurate quotas. In the Commission's view, the 0.25 per cent, or $600 000, proposed under the R & D levy arrangements is clearly inadequate as a contribution, especially as that research is not specifically for resource management purposes. A figure some times that amount could be more appropriate.

Decisions as to the amount which should be spent on research (to determine sustainable TACs, the appropriate level of fishing effort and the most suitable management regime) can only be rigourously determined in formulating Plans of Management. As the new arrangements require Plans of Management to be approved by Parliament, they are thus public documents and meet the criterion for transparency in public policy and expenditure of funds. The Commission recommends

that a Plan of Management incorporates an assessment of the costs of the necessary research to achieve the objective of sustainable, profitable fisheries. This assessment could be prepared by BRR. Such a requirement would be consistent with its charter. The Commission also recommends that the Plan of Management incorporates an explicit statement of how (by what means) and when the beneficiaries of this research will repay any publicly funded research.

Through the process of formulating a Plan of Management, fishermen will have the opportunity to evaluate the costs and benefits of the investment in research. Access rights to the fishery will need to be conditional on agreeing to payment of specified amounts at specified times for a specified period. These recommendations follow from the principles discussed in Chapter 2, in particular that research for the purposes discussed above is an investment decision and the beneficiaries should pay.

The amount of research needed, the extent that it is a private or public good, who the beneficiaries are, and when the benefits result will differ from fishery to fishery. Two examples illustrate this. In a fishery such as the Northern Prawn fishery (with a past history of considerable research, with no other users than commercial fishermen, and quickly approaching a profitable level of effort as a consequence of restructuring) the need for research is relatively low, the ability to pay is assured in the near future, and the commercial operators are, by and large, the beneficiaries. The South East Trawl fishery differs dramatically. A great deal of costly research is required, the time required to restructure it is uncertain (and hence ability to pay may not exist for some time in the future), and the beneficiaries will include both commercial and recreational fishermen. For the latter fishery, the Plan of Management and the costs associated with developing a sustainable fishery will have to recognise that both groups will ultimately benefit and will have to share in meeting the costs.

**Fishing industry management**

While the problems of common property and achieving collective action require a degree of government involvement in the management of the fishing industry, the role of government should be to enable the industry to manage its own business affairs like any other industry. The various sectors of the fishing industry are the overwhelming beneficiaries of improvements in the

management of the industry that reduce costs, increase returns, and improve the level and stability of profits. Industry management is necessary to ensure that resources are allocated efficiently within a fishery, once the basic resource management questions have been resolved. Industry management in this context is not full 'self-management' - resource management, surveillance and enforcement, monitoring, and licensing remain Government responsibilities - but is what the Commission terms 'co-management'.

There are a variety of things which fishermen acting collectively can do in this regard. These are outlined below. As these are industry initiated actions, they should be paid for by the industry.

In order to facilitate industry provision of collective services, the Commission recommends that the Commonwealth enable a body corporate to be set up in each fishery which desires one. This would overcome the free-rider problem and allow the industry to undertake activities collectively. The body corporate would be responsible for providing fishing industry management services to its members.

Where the majority of fishermen in a particular fishery support such a system, each fisherman would automatically be a member of the body corporate which would make decisions on the basis of a fair voting system. This would be similar to the bodies corporate that manage strata titled buildings, where the owner of each unit is automatically a member.

Such bodies corporate would give fishermen a greater say in how their fisheries were conducted. It would improve their negotiating position with other industry sectors. It is likely to increase their commitment to the management plan, thereby enhancing the quality of compliance and reducing its costs.

Determining what and how certain fishing industry management services should be provided in a fishery can be most efficiently done by the participants in the fishery themselves, rather than by government agencies remote from the fishery.

Activities to enhance the performance of the fishery could include: research on particular problems in the fishery; 'real time' management; marketing and product enhancement; training; and occupational health and safety.

It is also possible for industry to initiate and implement restructuring through voluntary buy-back in fisheries which do not automatically rationalise themselves as with ITQ management. As the body corporate would be able to acquire assets on behalf of the fishery, it would also be possible for the industry to undertake projects, such as artificial breeding and restocking, which could enhance the productivity of the fishery.

Such a system of co-management is inherently very flexible. No two fisheries are likely to be exactly the same. It should be much easier for a stable fishery to take on these responsibilities than one which is subject to major restructuring. It will be more difficult to implement co-management in a fishery which is shared between commercial and large numbers of recreational fishermen. Nevertheless, the principle should be encouraged.

### Foreign fishing

The Commission supports the continuation of current arrangements for the full recovery of all costs associated with the activities of foreign fishing vessels in the AFZ, as well as the payment of access fees equivalent to anticipated rents from the operation. At the moment, these access fees are negotiated on a Government to Government basis. Some submissions claimed that the fees had often been set too low in the past. A number of other submissions were critical of the policy of allowing foreign vessels to fish at all, displacing Australians.

The Commission considers that there could be merit in allocating rights to foreigners by open auction, in which Australians would also be able to participate. This could stimulate competition and improve the prospects of obtaining an appropriate return to the Australian community. It would also ensure that where Australian fishermen were able to operate as efficiently as foreigners, they would not be constrained in their ability to obtain fishing rights.

## 6.5 Recreational fishing and other uses

Many submissions emphasised the growing pressure of recreational fishing on stocks and the conflict between recreational and commercial in terms of gear and access. A number of States have been developing recreational fishing policies and the Australian Fisheries Council has set up a working party on recreational fishing. Funds available for the management of recreational fishing at both Commonwealth and State levels are limited.

These considerations lead the Commission to conclude that a national approach is needed to both the management of recreational fishing and to charging recreational fishermen. A method of raising revenue for the management of recreational fishing should be agreed between the Commonwealth and the States, with revenue allocated to high priority areas of resource management such as research, allocation of fishing rights and education of fishermen.

In theory there are a number of different ways by which recreational fishermen could contribute to the costs of resource management. Some advocated earmarking of indirect taxes on fishing gear but, as discussed in Chapter 4, this is basically incompatible with Australia's indirect tax system. Another way is the purchase of tags related to bag limits, but the transactions costs of this approach appear to be quite high. The conventional method is a recreational fishing licence.

The Commission recommends that the Commonwealth and the States/Territories cooperate to levy a universal recreational fishing licence which would be compulsory for all anglers over the age of 18.

Given the uncertainties about the extent and effects of recreational fishing, it is difficult to estimate how much should be raised. The Australian Fisheries Council's Working Group on Recreational Fishing may be able to shed further light on this matter. It is clear that research into these issues should be a high priority, especially for those fisheries with heavy recreational use and competition between recreational and commercial fishing. Education of anglers on management goals and methods must also be an important element of management of recreational fishing. Rehabilitation of depleted fisheries could also be an objective. The licence system should be set at a level sufficient to have a significant impact in meeting this objective. It must also cover its costs of administration. A licence fee of about $20 for every angler over the age of 18 might be an appropriate sum.

Similar considerations should apply to other users of the living marine resources of the AFZ. Viewing of marine life is an important activity for tourists in the Great Barrier Reef and other areas interesting to divers and operators of fish viewing platforms such as glass bottom boats and marine observatories. Commercial and recreational fishing can conflict with these uses. Such users should also contribute to the costs of resource management.

In certain limited circumstances the government may decide to waive recovery of resource management costs. For example, the treaty obligations and social objectives in the Torres Strait justify the current policy of assisting the Torres Strait Islanders with their fishing activities without cost recovery. However, commercial fishermen within the Torres Strait should bear the full costs that they would be expected to bear in another fishery.

## 6.6 Streamlining institutions

If users are to pay a larger proportion of resource management costs than they have in the past, they must be assured that the quality of resource management will be much better than in the past. The problem is that the current institutional framework which has evolved over the century is ill equipped to meet the challenges of modern fisheries resource management. Fragmentation rather than integration of functions and jurisdictional divisions within ecologically unified fisheries have led to fisheries management in which both the fish and the fishing industry have been the losers.

The challenge is to formulate the appropriate institutional framework. The aim of fishery resource management should be to ensure optimum utilisation of the living resources of the AFZ. Resource management should ensure that all objectives relating to optimal use of marine resources are taken into account, such as ecological sustainability, conservation, and national sovereignty, as well as catching by traditional, recreational and commercial fishermen.

The principal means of achieving these objectives is through the continuing development, implementation, monitoring and evaluation of plans of management. These plans should aim to be efficient and cost-effective from the point of view of the nation as a whole, not just the Commonwealth Government or the members of a particular commercial fishery. Resource management requires the bringing to bear of knowledge and data from various disciplines. Such knowledge and data have to be integrated and then policies developed and implemented to achieve the over-riding objective of long-term optimal use.

Responsibility for marine resource management should lie with a multi-disciplinary expert body able to determine priorities and integrate scientific, economic, social and policy considerations, reporting to appropriate Ministers. There is some experience of this approach in Australia, with GBRMPA and the Western Australian Department of Fisheries being examples. This is not to suggest that either of these organisations are completely successful in this regard, but only to indicate that they are attempting to apply an integrated, or holistic, approach in their respective jurisdictions.

The creation of AFMA is an attempt to improve accountability and decision making in Commonwealth fisheries. However, while AFMA might be more accountable to the commercial fishing industry, it does not adequately address the underlying problems of management of the resources of the AFZ as a whole. While AFMA should be involved with the resource management of specific exploited fisheries, a body conceived as primarily concerned with a particular objective or sector, such as commercial fishing, cannot undertake the basic tasks involved in ensuring successful multiple use of the marine ecosystems of the AFZ.

In the Draft Report, the Commission proposed that an Australian Fishing Zone Authority be established to be responsible for optimal utilisation of the living marine resources of the AFZ. The Commission also pointed to the need for resolution of Commonwealth/State jurisdictional issues and for the urgent finalisation of OCS arrangements. Renegotiation of existing OCS arrangements to bring ecologically linked fisheries under unified management is also required.

The Draft Report Hearings provided support for the Commission's view that Commonwealth/State jurisdictional issues should be resolved urgently and that each fishery should be defined in ecological terms and managed by a single agency. All State Government submissions supported the desirability of early resolution of jurisdictional issues and the need for improved coordination of high level resource management in the AFZ. Appendix L presents a selection of views expressed by participants at the Draft Report Hearings on the issue of an Australian Fishing Zone Authority.

In light of this discussion, the Commission considers that an authority should be established by the Commonwealth and the States to provide a framework for the coordinated multiple-use management of the AFZ in keeping with the principles of ecologically sustainable development. This AFZ Authority would not be involved in operational management of particular uses of marine resources such as fishing. Specific operational fisheries resource management would be undertaken by fisheries management agencies such as AFMA. Their performance would be subject to monitoring by the AFZA.

The creation of AFZA as a small, expert, resource management agency funded entirely by government and responsible to a council of Commonwealth and State ministers would help to focus research and other elements of resource management on issues of high priority.

Clearer delineation of responsibilities, priorities and financial arrangements for the basic management of the living marine resources of the AFZ will also simplify and clarify fisheries management. This would allow AFMA to meet the expectations which both industry and Government have had for it.

**The Future**

The concluding comment is left to the senior fisheries scientists with the Bureau of Rural Resources (Williams and Reichelt, 1991):

> All governments find it difficult to manage fisheries resources from sustainable production. They have to cope with resources that are not well defined in their size, predictability in space and time, productivity and their interrelations with other living and non-living parts of the marine ecosystem. Fisheries managers attempt to maintain stocks by regulating fishing activity which in turn is affected by a range of social, economic and technological factors.

By the year 2001, Australia's fisheries resources will be managed in new ways. They will be managed as integral and interacting components of marine ecosystems. Management will balance access to the resources by commercial and recreational fishers. Within the commercial sector, fishers will have access to a range of fish species and potential for inter-annual transfers of quota in suitable species.

Some traditional fishing methods will be limited or altered because of their potential to adversely affect marine habitats, and because of community attitudes towards fish welfare. The impacts of environmental factors on fish habitat and productivity will be better understood than at present but will need further work to define the effects quantitatively.

Underlying all of these changes will be a body of information on fisheries resources, industry and environmental matters. Access to information is vital to good fisheries management. Even so, lack of sufficient information will still be an impediment to predicting sustainable catches in most stocks and therefore to good resource management.

# APPENDIX A: CORRESPONDENCE RELATING TO FISHERIES LEGISLATION

Attachments:

1. Letter to Senator B Childs from the Minister for Primary Industries and Energy dated 17 June 1991.

2. Media Release by Minister for Primary Industries and Energy dated 6 August 1991.

Attachment 1

Senator B Childs
Chairman
Senate Standing Committee on Industry,
Science and Technology
Parliament House
CANBERRA ACT 2601

Dear Senator Childs

I understand that during the public hearings of the Senate Standing Committee on Industry, Science and Technology relating to the package of fisheries legislation before that Committee, there were two matters on which undertakings to report back to the Committee were given.

These matters were:

(a) the level of expenditure associated with the selection processes for the Boards of the proposed Australian Fisheries Management Authority and the new Fisheries Research and Development Corporation and

(b) a proposal from Senator Archer that I provide a further assurance to the fishing industry that the commitments provided in relation to industry contributions to management costs be extended to 30 June 1992, and not as it now stands, that is until the Government has determined its response to the Industry Commission Report on Cost Recovery for Fisheries Management.

In relation to (a), expenditures are not finalised and bills are still being received, but final costs are estimated to be close to but less than $150,000.

On the second issue, I am happy to provide such an assurance. Indeed in developing a draft budget for the new Authority for 1991/92, it clearly has been assumed that the industry will not be required to pay more in real terms than they currently do for Commonwealth fisheries management for the full duration of the next financial year. As was indicated to the Committee, the Industry Commission is not due to report back to the Government until December. It is unlikely that the Government will determine its response to the report until well into the 1992 calendar year.

However, to alleviate the concerns about these and related matters expressed during the course of the Committee's public hearings, should the legislation receive passage now, I am prepared to extend the assurance I have already given. I will also agree

- that the Government will consult widely with the fishing industry before it finalises its responses to the Industry Commission Report

- make a Statement to Parliament to outline the Government's response to that report

- as per above, ensure that the industry contribution in aggregate to AFMA costs will not be greater in real terms for the duration of 1991/92 than for 1990/91

- ensure that AFMA expenditures for fisheries management overall in 1992/93 and 1993/94 will not be greater in real terms than like expenditures in 1990/91, excepting of course voluntary levies and other costs set by industry and

- a review will be undertaken of AFMA finances at the end of the 1993/94 financial year.

At the Committee hearings, questions were also raised about the provisions for the allocation of statutory fishing rights through tender or auction. This is covered under division 4 of Part 3 (Clauses 23 to 29) of the Fisheries Management Bill 1991.

The allocation of statutory fishing rights by auction or tender can only be done where this form of allocation is specified in a plan of management (paragraph 16(6)(d)). In developing a plan of management, AFMA must consult with the industry and must take account of representations received. A plan of management must also be approved by the Minister and lie before both Houses of Parliament and is subject to disallowance by either House.

It is not anticipated that these provisions will receive significant usage. They are designed for use where exploratory fishing identifies significant and unexpected new resources. It is primarily intended as an efficient way of allocating rights rather than as a revenue raising mechanism.

I trust that the above will be seen by your Committee as a positive response to the points made during this morning's hearings.

Yours sincerely

SIMON CREAN

Attachment 2

## FISHERIES BILLS DELAY REQUEST

The Primary Industries and Energy Minister, Simon Crean, has asked the Senate Standing Committee on Industry, Science and Technology to defer its deliberations on the fisheries legislation currently before the Senate, pending public release of an Industry Commission draft report on fisheries.

Mr Crean said that the decision to ask the committee to defer deliberations was based on the expected release on August 16th of the Commission's Draft Report on Cost Recovery for Fisheries Management.

"It has become apparent that the report will contain recommendations on matters beyond just cost recovery issues," he said.

"This is contrary to previous perceptions of the outcome of the IC draft report."

"I have asked the committee to defer its meeting scheduled for August 7th, so that I may have the benefit of the committee's views on the Industry Commission's report."

The Fisheries Bills would set up a range of mechanisms within the fishing industry, including the establishment of the Australian Fisheries Management Authority.

# APPENDIX B: LIST OF PARTICIPANTS AND SUBMISSIONS

| Name | Sub No |
|---|---|
| Alvey Reels (Australia) | 10,72 |
| Andresen, Mr Jorgen | 3 |
| Atterton, Mr R.D. | 4 |
| Australian Anglers' Association (Vic) Inc. | 29 |
| Australian Fishing Tackle Association Inc. | 30,85 |
| Australian Government | |
| Australian Bureau of Agricultural Resource Economics | 54 |
| Australian Maritime Safety Authority | 82,96 |
| Australian National Parkes & Wildlife Service | 69 |
| Australian Quarantine & Inspection Service | 59 |
| Bureau of Rural Resources | 52,95 |
| CSIRO Division of Fisheries | 27,46,75 |
| Department of Finance | 79 |
| Department of Foreign Affairs & Trade | 66 |
| Department of Primary Industries & Energy - Minerals & Fisheries Group | 43,80 |
| Department of the Arts, Sport, the Environment, Tourism & Territories | 81 |
| Great Barrier Reef Marine Park Authority | 60,70 |
| Australian Recreational & Sport Fishing Confederation (Inc.) | 45,78 |
| Campbell, Professor H.F., Professor of Economics, University of Tasmania | 14 |
| Celestial Holdings | 39 |
| City of Port Lincoln | 36 |
| Commercial Fishing Advisory Council | 18 |
| Doyle, Mr Peter | 55 |
| Evans, Mr J.C. | 76 |
| Fishing Clubs Association of N.S.W. | 51 |
| Game Fishing Association of Australia Inc. | 24 |
| Great Australian Bight Industry Association | 41 |
| Haldane, Catharina B.J. | 6 |
| Harrison, Anthony | 28 |
| Kesteven, G.L. and Associates | 1,26 |
| Leeuwin Star Pty Ltd | 2 |
| Master Fish Merchants' Association of N.S.W | 53 |

| Name | Sub No |
|---|---|
| Mitchell, Mr Murray | 7 |
| Moran, T.J. & J.J. Pty Ltd | 38 |
| National Fishing Industry Council (NIFIC) | 48,77,90,93 |
| Newfishing Australia Pty Ltd | 23 |
| New South Wales Fishing Clubs' Association | 88 |
| New South Wales Government - Fisheries Division | 92 |
| Northern Fishing Companies Association Ltd ) | |
| Northern Prawn Fishery (Qld) Trawl Association ) | |
| Northern Territory Trawler Owners Association ) | |
| Western Australian Northern Trawler Owners Ass ) | 11 |
| Northern Territory Department of Primary Industry and Fisheries | 31,83 |
| Northern Territory Fishing Industry Council | 25 |
| NPF Industry Organisation | 56 |
| Olsson, Mr C. | 57 |
| Pearl Producers Association | 35 |
| Port Macdonnell Professional Fishermens Association | 12 |
| Professional Fishermen's Assoc. of Tasmania | 22 |
| Pyke, Dr L.H. | 73 |
| Queensland Commercial Fishermen's Organisation | 62 |
| Queensland Government | 63,94 |
| Sevrup Pty Ltd | 65 |
| Small Boat Operators Association Inc | 71 |
| South Australia Oyster Growers Association | 58 |
| South Australian Government - Department of Fisheries | 64 |
| South Australian Fishing Industry Council Inc | 16,84 |
| South Australian Fishing Industry Council Inc - Scale Fisheries Committee | 9 |
| South Australian Fishing Industry Training Council | 8 |
| South Australian Seafood Marketers & Processors Assoc. | 17 |
| South Australian Shark Fishermen's Association | 34 |
| South East Professional Fishermen's Association | 15,87 |
| South East Trawl Fishing Industry Association | 32 |
| Spencer Gulf & West Coast Prawn Fishermen's Association Inc | 5 |
| Stehr Group | 37 |
| Tasmanian Amateur Sea Fishermans' Association Inc. | 89 |
| Tasmanian Fishing Industry Council | 50 |
| Tasmanian Government | 61 |
| Tasmanian Sashimi Tuna Fisherman's Association | 44 |
| Trawler Owners Association of Australia Ltd | 68 |
| Tuna Boat Owners Association of Australia | 40,49 |
| Valente Seafood Processors Pty Ltd | 42 |
| Victorian Government | 67,74 |
| Victorian Scallop Industry Assocation | 47 |
| Walker, Dr Michael H. | 20 |

| Name | Sub No |
|---|---|
| Western Angler Magazine | 91 |
| Western Australian Government - Fisheries Department | 13 |
| Western Australian Fishing Industry Council (WAFIC) | 21,86 |

# APPENDIX C: ORGANISATIONS, COMPANIES AND INDIVIDUALS CONSULTED

| | | |
|---|---|---|
| Professor H.F. Campbell<br>University of Tasmania | 11 December 1990 | Hobart |
| City of Port Lincoln | 12 February 1991 | Port Lincoln |
| Commercial Fishing Advisory Council | 20 March 1991 | Sydney |
| Craig Rough Fisheries | 13 February 1991 | Port Lincoln |
| CSIRO Division of Fisheries | 11 December 1990<br>28 February 1991<br>2 October 1991 | Hobart |
| Fremantle Fishermens Co-operative | 5 December 1990 | Perth |
| Great Barrier Reef Marine Park Authority | 21 February 1991 | Townsville |
| Kailis & France | 5 December 1990 | Perth |
| Lakes Entrance Fishermen's Co-operative Entrance | 25 February 1991 | Lakes |
| Manetos & Son | 20 March 1991 | Sydney |
| National Fishing Industry Council | 28 January 1991<br>27 August 1991<br>5 September 1991<br>20 September 1991<br>27 September 1991<br>25 November 1991 | Canberra |
| NSW Department of Agriculture & Fisheries | 20 March 1991 | Sydney |
| NSW Department of Agriculture & Fisheries, Fisheries Research Institute | 22 May 1991 | Sydney |
| NSW Fish Marketing Authority | 20 March 1991 | Sydney |
| Northern Fishing Companies Association Ltd | 18 February 1991 | Cairns |

| NAME | DATE | VENUE |
|---|---|---|
| Northern Prawn Management Advisory Committee | 21 February 1991 | Cairns |
| Northern Territory Fishing Industry Council | 19 February 1991 | Cairns |
| NT Trawler Owner Operators Association | 19 February 1991 | Cairns |
| Northern Zone Rock Lobster Association | 13 February 1991 | Port Lincoln |
| Queensland Commercial Fishermen's Organisation | 20 February 1991 | Cairns |
| Queensland Department of Family Services & Aboriginal and Islander Affairs | 18 February 1991 | Brisbane |
| Queensland Department of Primary Industry Fisheries Division | 18 February 1991 | Brisbane |
| Queensland Fish Management Authority | 18 February 1991 | Brisbane |
| A Raptis & Sons | 14 February 1991 | Adelaide |
| Senate Standing Committee on Industry, Science & Technology | 16 August 1991<br>23 August 1991 | Canberra |
| SA Department of Fisheries | 14 February 1991 | Adelaide |
| SA Fishing Industry Council Gulf St Vincent representatives | 14 February 1991 | Adelaide |
| SA Fishing Industry Council Scale Fisheries Committee | 13 February 1991 | Port Lincoln |
| SA Recreational Fishermens Advisory Council | 14 February 1991 | Adelaide |
| SA Shark Fishermens Association | 13 February 1991 | Port Lincoln |
| Spencer Gulf & West Coast Prawn Fishermens Association | 12 February 1991<br>9 October 1991 | Port Lincoln<br>Bowden |
| Tasmanian Department of Primary Industry Sea Fisheries Division | 11 December 1990 | Hobart |

| NAME | DATE | VENUE |
|---|---|---|
| Tasmanian Fishing Industry Council | 1 March 1991 | Hobart |
| Trawl/Crayfish representatives | 26 February 1991 | Millicent |
| Tuna Boat Owners Association | 12 February 1991 | Port Lincoln |
| Valente Seafoods | 12 February 1991 | Port Lincoln |
| Victorian Department of Lands, Conservation & Environment | 27 February 1991 | Melbourne |
| Victorian Fishing Industry Council | 27 February 1991 | Melbourne |
| Western Australian Department of Fisheries | 5 December 1990 | Perth |
| WA Fishing Industry Council | 5 December 1990 | Perth |

# APPENDIX D: COMMONWEALTH AND JOINTLY MANAGED FISHERIES

Great Australian Bight Trawl Fishery

Northern Prawn Fishery

Southern Bluefin Tuna Fishery

South East Trawl Fishery

Bass Strait Scallop Fishery

East Coast Deepwater Crustacean Fishery

East Coast Deepwater Finfish Trawl Fishery

East Coast Tuna Longline Fishery

East Coast Tuna *Purse Seine* Fishery

Kimberley Coast Prawn Fishery

Norfolk Island Deepwater Fishery

North West Slope Trawl Fishery

Northern Fish Trawl Fishery

West and North Western Deepwater Trawl Fishery

Torres Strait Protected Zone Fisheries

Demersal Gillnet Fishery in Waters South of Latitude 33o South (jointly managed with Western Australia)

Joint Authority Line Fishery in Waters South of Latitude 33o South (jointly managed with Western Australia)

Pearl Oyster Fishery (jointly managed with Western Australia and the Northern Territory)

# APPENDIX E: THE AUSTRALIAN FISHING INDUSTRY

In 1990-91 the country's fish harvest had a landed value of $1170 million. Commonwealth managed fisheries accounted for $273 million (ABARE 1991b, p. 4).

Although jurisdiction over the AFZ is split between the Commonwealth and the States, fishing operations are not. The available data does not always allow a clear separation between Commonwealth and State fisheries, and the industry structure, the processing and wholesaling sectors and the market for fish are common to both. Hence this section looks at the Australian fishing industry as a whole.

In 1990-91, the most important Commonwealth fisheries were Northern Prawn ($110 million), South East Trawl ($71 million) and Southern Bluefin Tuna ($50 million) (ABARE 1991b, p. 4). The main State fisheries include Western Australian Rock Lobster, Western Australian Pearl, Western Australian Prawn and the East Coast Trawl in Queensland.

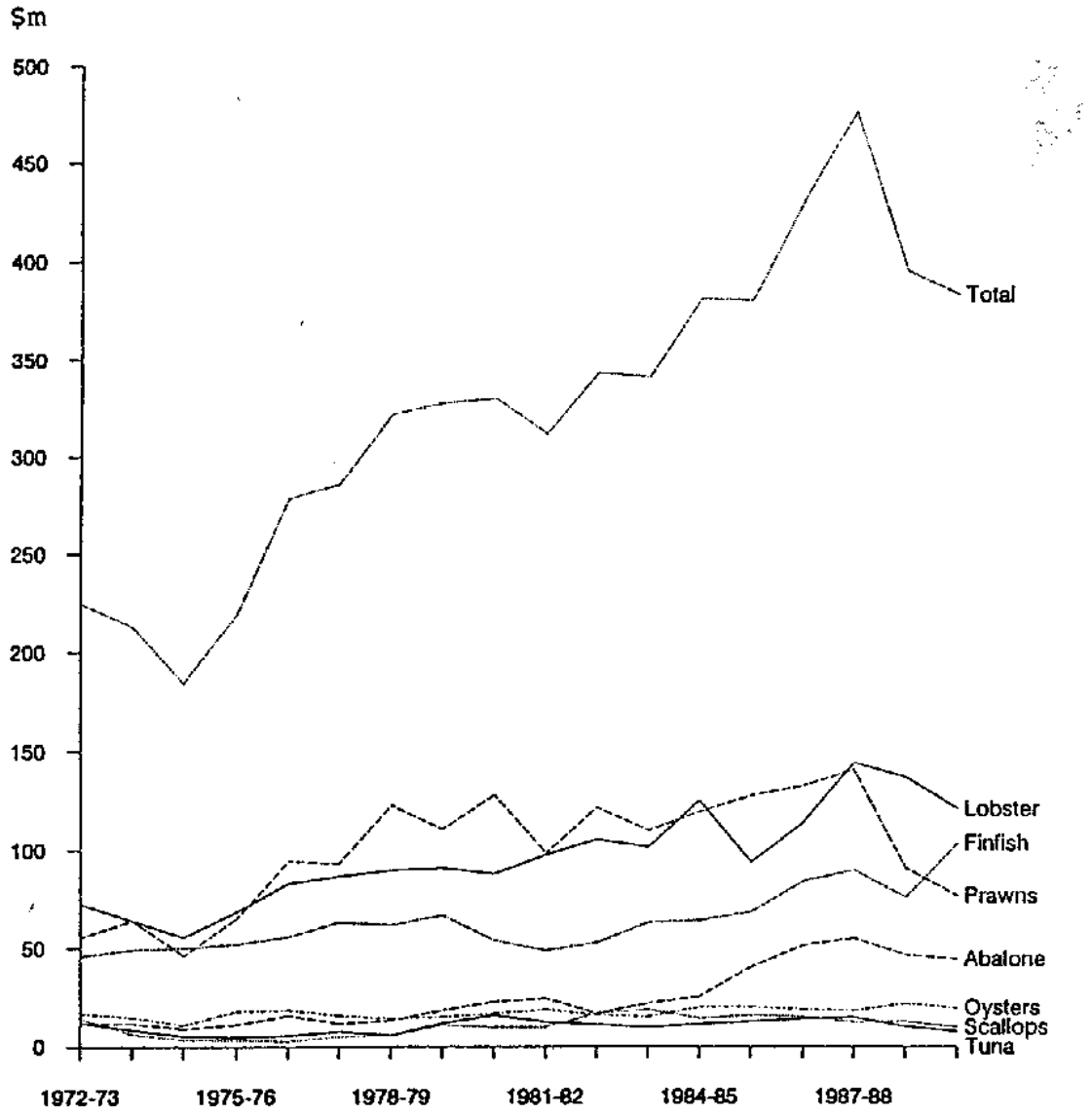
Figure E.1 shows that the value of the Australian fish catch is now roughly double what it was twenty years ago. The figure also indicates that lobsters and prawns are generally the most valuable component of the total catch. Over the last 10 years they each averaged 30 per cent of fishery production by value. Fin fish have been 19 per cent on average over this period and abalone 9 per cent. The most noticeable changes in recent years have been a fall in the value of the prawn catch and an increase in the value of finfish due mainly to the increased catch of orange roughy.

### The state of the resource

By world standards the extent of fish resources is quite small. As Kearney (1989, p. 1) states:

> Because Australia has a limited continental shelf and few major upwellings or major oceanographic processes resulting in enrichment, we have not been blessed with great fish resources.

Figure E.1: **Value of fisheries production 1972-73 to 1989-90 (in 1980-81 prices)**




Source: ABARE, *Commodity Statistical Bulletin 1990*. Current prices deflated by CPI.

Australia's contribution to the total world catch by weight is only of the order 0.2 per cent.

Excessive depletion of the fish stock through overfishing is a common problem in Australian fisheries and has occured to some extent in most of those under Commonwealth control. The worst among these is the Bass Strait scallop fishery where the fish stock has collapsed. The fishery has been closed until it recovers. The southern bluefin tuna catch has declined from over 81 000 tonnes

in 1961 to its current level of not much more than 11ÿ000 tonnes. The Commonwealth is currently considering drastic reductions in the total allowable catch in the Southern Shark fishery in response to declining stocks, and there exists the possibility of a prohibition of any fishing for an extended period. In the South East Trawl fishery a number of fish species are in danger.

Species can suffer growth overfishing (when the annual catch is greater than the additions due to growth and recruitment) and recruitment overfishing (when the number of spawning fish is reduced below the level required for replenishment). In a species which matures when several years old and lives a long time, it may be years before the effects of recruitment overfishing show up in the catches when the effect can be quite dramatic. Once exposed to recruitment overfishing, a stock may take a long time to recover. This is a problem for long lived species such as shark, tuna and orange roughy. Species such as orange roughy and southern bluefin tuna that aggregrate are particularly vulnerable. The condition of stocks in particular fisheries are discussed in more detail in Appendix G.

**Ownership and investment**

Fishing in Australia is generally conducted by small businesses (ie unincorporated entities) with boats usually operated by their owners. Larger operators are more prominent in the prawn, pearl and orange roughy fisheries, as is vertical integration into boat building, wholesaling and processing.

While the industry is generally competitive and fragmented, this is modified somewhat by the presence of fishermen's cooperatives in some fisheries. These coordinate the sale of the catch, possibly giving the fishermen some market power in their dealing with purchasers. In the case of the Spencer Gulf prawn fishery in South Australia the industry association coordinates the actual catching activities of all its members.

Improvements in fishing technology have increased the fishing power of boats and also the capital intensity of many operations. Many technological developments have occurred in the past two to three decades: for example gear has improved, refrigeration is in widespread use, and accurate satellite navigation equipment (Global Positioning Systems) enables operators to target productive areas of the ocean where previously they could not accurately position their vessels. Refrigeration has had an impact on shore-based processing and in the Northern Prawn fishery, for example, has led to the closure of some processing plants.

AFS estimates there were 9090 boats in the Australian fishing fleet at June 1985. Today about 800 have Commonwealth Fishing Boat Licences endorsed to operate in Commonwealth fisheries. Some of these boats are entitled to fish in more than one Commonwealth fisheries or to also fish in State fisheries. Table E.1 shows the number of boats endorsed to fish in the major Commonwealth fisheries.

Table E.1: **Boats by major Commonwealth fishery, 1991**

| | |
|---|---|
| Northern Prawn | 175 |
| South East Trawl | 135 |
| Southern Bluefin Tuna | 77 |
| Southern Shark Gillnet | 157 |
| East Coast Tuna Longline Fishery | 170 |

Source: AFS

### Factors affecting the profitability of the industry

The profitability of fishing is affected by the prices received for the fish, the state of the fish stock, the level of fishing effort in the fishery and fishing costs.

Figure E.2 indicates that prices received for lobster and prawns have fallen back from the unusually high prices received in the previous two or three years. The fall in prices received was mainly due to a strengthening of the Australian dollar relative to the currencies of our main export markets, the Japanese yen and the US dollar. While prawn prices are beginning to rise again they are not expected to return to their pre-1986 levels.

Where a stock has been depleted, the level of fishing effort required to catch a given quantity of fish will be greater. As discussed above stock depletion is a serious problem in some fisheries. Overfishing is a major cause of this problem. The profitability of one fisherman is going to be affected by the number of other fishermen competing for the same fish. This problem of over-capitalisation is extensive and affects all Commonwealth fisheries.

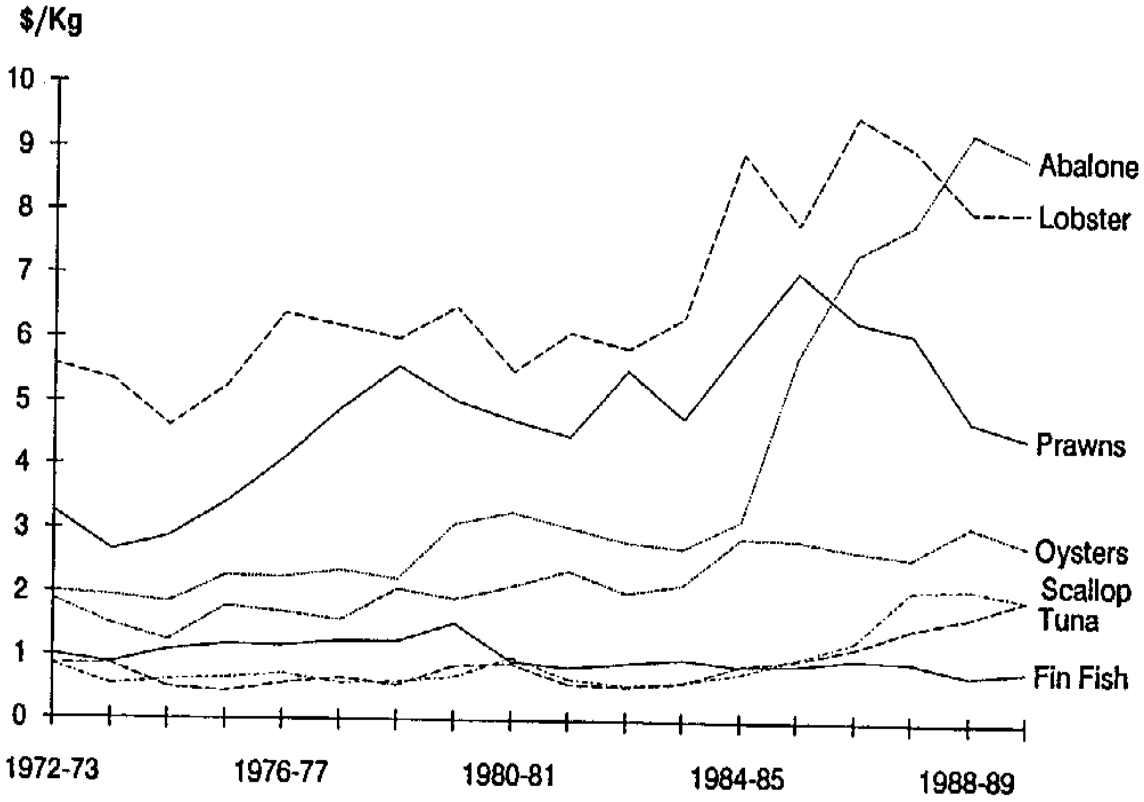
The composition of fishing costs varies between fishing vessels and between fisheries. According to the Australian Bureau of Agricultural and Resource Economics (ABARE), variable costs can in general terms be broken down as follows: labour 40-45 per cent; fuel 20-30 per cent; and vessel repairs and maintenance about 25 per cent (Smith 1989, p. 7). The cost of employed labour in most fisheries is tied to the value of the catch. Fuel depends on trends in world oil prices and the strength of the Australian dollar relative to the US dollar, the denominator currency of crude oil pricing. Repair and maintenance costs depend in part on the effect of exchange rate movements on the price of imported parts and equipment. Management costs are a small but significant addition to costs. In 1990-91 AFS cost recovered $5.7 million from domestic fishermen. This was 2.4 per cent of the value of the catch from Commonwealth fisheries.

The cost of boats varies considerably. Some of the larger and newer boats in the Northern Prawn and South East Trawl fisheries are worth over $1 million. In many cases the boats are old and would sell for very little, although the cost of replacement would be far greater.

Under certain circumstances fishermen can obtain super normal profits resulting from the relative abundance of fish in the fishery and the resulting ease of catching them. In some cases this extra return would have been a temporary windfall to fishermen during the fishdown stage. It can be eroded through overfishing, dissipated through excessive investment in the fishery or capitalised by fishermen who have sold their fishing entitlement and left the industry. An indication of the extent of these rents is the market value of various fishing entitlements. According to the South East Trawl Fishing Industry Association (SETFIA), in 1990 it would have cost $1.81 million to purchase the necessary 'boat units' for a typical 30 metre boat.

Fishery management should improve the efficiency and profitability of the industry by preventing both overfishing and overcapitalisation through controls on fishing. However, as Chapter 5 shows, the history of management both in Australia and overseas has generally not been good in this regard. Management regimes can sometimes exacerbate resource management problems and the efficiency and profitability of fishing.

Figure E.2 **Real average fish prices 1972-73 to 1989-90 (base year 1980-81)**




Source: Derived from figure E.1 and quantity data in ABARE, *Commodity Statistical Bulletin 1990*.

There are, however, some significant cases where fishery management has improved the lot of fishermen. In the Western Australian Rock Lobster fishery the ability of management to predict the size of the catch enables fishermen to plan their fishing and expenditure decisions accordingly. 'Real time' management in the Spencer Gulf Prawn fishery enables the coordination of fishing effort and the timing of the delivery of the catch to the market to ensure maximum returns.

## The market for fish

The export market is the most important market for prawns, lobster and abalone while finfish, with the exception of orange roughy, are mainly destined for the domestic market. Table E.2 shows the supply and utilisation of seafood in Australia for 1990.

Table E.2: **Supply and utilisation of seafood in Australia, 1990 (in tonnes[a])**

| | | *Imports* | *Exports* | *Production commercial* | *Total supply* |
|---|---|---|---|---|---|
| Fish | - Australian | | 7 512 | 52 250 | 57 475 |
| | - Imported | 32 382 | 414 | - | 32 382 |
| Crustacea and molluscs | | 4 879 | 18 072 | 29 185 | 34 064 |
| Prepared seafood | - Australian | | 3 053 | 11 123 | 10 916 |
| | - Imported | 35 340 | 61 | - | 35 340 |
| Totals | | 72 601 | 29 112 | 92 558 | 170 177 |

a) Fresh and frozen, edible weight
Source: Skurray & Saee 1991

### *Exports*

About 70 per cent of the catch by value is exported. The industry is Australia's fifth largest rural exporter. Over the period 1987-88 to 1989-90 fish comprised 4 per cent of the value of rural exports.

In 1988-89 lobsters and prawns comprised about a third each of the value of exports, while abalone made up about a quarter. In recent years orange roughy has been the most important demersal finfish export, mainly in the form of frozen fillets to the United States market. Tuna is exported both fresh and frozen. The sashimi market pays high prices for large fresh fish in perfect condition. The shift from purse-seining to longlining as a catching method, and the increasing care being given to preserving the quality of the catch, have allowed a higher proportion of Australian tuna exports to be made to the sashimi market. Annual exports of canned, smoked, dried and salted finfish are less than $2 million per year.

Fish exports are concentrated in a few major markets. In recent years Japan has taken about a half of exports and the USA a quarter or less. Almost all lobster exports go to those two markets. Australian rock lobster tails have a significant share of the US market as do live rock lobsters in the Japanese market. Australia has an advantage in the Japanese market because of the similarity in appearance of the Australian product to the domestically caught variety. Australia is a major supplier of abalone to the Japanese and Hong Kong markets. Japan takes almost all prawn and tuna exports but the Australian market share is small and market power is insignificant.

*The domestic market*

While seafood has never been a major item in the Australian diet especially when compared with other meat, there has been a steady increase in per capita consumption over the last two decades. This has been due in part to the increased perception of fish as a healthy food. From 1984 to 1990 seafood consumption increased dramatically from 6.3 kg to 7.9 kg per capita per year (Skurray and Saee 1991).

In 1989-90 Australia imported $414.4 million worth of seafood. This comprised 60 per cent of total domestic consumption. About 25 per cent of imports are of fresh, chilled or frozen finfish products, while prawns and canned fish each comprise about 20 per cent. About a third of fresh, chilled or frozen fish comes from New Zealand. Canada, Thailand and the USA each supply about a quarter of our canned imports. Salmon comprises about half the value of canned imports, tuna 15 per cent and sardines 10 per cent.

Some imports have advantages over the local product due to lower costs and more reliable supply. With the exception of orange roughy Australian finfish is not available in high volume and hence there is less scope for economies of scale. Australian fish catches also tend to be seasonal.

One reason for the unwillingness of the domestic fish catching and processing industry to support the collective provision of marketing and promotion activities for fish is that importers would capture some of the benefits. This is true to the extent that the domestic product cannot be differentiated from the imported one.

## Fish processing

The extent to which the fish catch undergoes processing varies considerably, depending on the species and the consumer preferences for the final product. About 90 per cent of the catch by weight is sold in fresh or frozen form. The only canning is for tuna, abalone and cat food and a small amount of fish is reduced to meal and oil. A significant proportion of the fish used in local production of highly processed goods such as canned fish or crumbed fillets is imported.

Depending on the species, processing is undertaken on-board, on-shore, or a combination of both. On-shore processing establishments vary greatly in the size and scope of operation and the sophistication of the technologies employed. The vast majority are on a small scale and undertake only the most basic cleaning, filleting, packing and freezing processes, much of which is very labour intensive.

Victoria has 107 establishments holding state processing licences, Queensland 268, Western Australia 256, South Australia 364 and Tasmania 47. New South Wales does not license its fish processors. There are 938 establishments registered with AQIS as fish exporters.

According to the last manufacturing census, in 1986-87, the 91 establishments classified by the ABS as principally engaged in seafood processing had a turnover of $714 million and a value added of $156 million. This does not include establishments which undertake processing but have as their primary activity fishing, wholesaling or general food processing. Table E.3 shows production for the main seafood products where the processing was undertaken by manufacturing establishments. Enterprises where the predominant activity is fishing or wholesaling are not included.

## Employment

The Australian fishing catching, processing and wholesaling industries employ about 30ÿ000 people. The catching sector employs 21 000[1] people while processing and wholesaling both employ at least 4000 people each. Employment is seasonal in most fisheries, but there may be employment for most of the year in multi-species fisheries. The number employed in the catching sector has been fairly constant over the last 20 years.

[1] AFS estimates.

Table E.3: **Domestic production of certain prepared and preserved seafood 1986-87 (sales and transfers out)**

| | *Tonnes (product weight)* | *$'000* |
|---|---|---|
| Frozen fish fillets | 3 169 | 20 870 |
| Canned fish (excl. canned pet food) | 8 367 | 41 533 |
| Fish fingers or portions, battered or crumbed and other prepared or preserved fish (excl. pet food) | 12 543 | 50 797 |
| Chilled or frozen (either fresh or boiled) | | |
| abalone | 837 | 24 711 |
| prawns | 10 203 | 176 320 |
| lobster | 5 860 | 188 477 |
| other crustaceans and molluscs | 2 628 | 37 053 |
| Other than chilled or frozen | | |
| abalone | 1766 | 68 071 |
| other | 146 | 1 782 |
| Total | 571 360 | 609 614 |

Source: ABS, *Manufacturing Commodities, Principal Articles Produced*, Australia, Cat. No. 8303.0.

## Industry structure

Industry structure and concentration influence the incidence of benefits and costs of fisheries management because they determine to what extent each sector can retain benefits and pass on costs.

The degree of concentration of market power at different levels of the industry determines the extent to which cost and price signals are transmitted between these levels. Industry structure and the commercial relationships between fishermen on the one hand and wholesalers and processors on the other vary considerably both between fisheries and to some extent within fisheries. In some cases fishing boats are owned by vertically integrated companies that are also involved in wholesaling and processing, for example Kailis and France, and Raptis. Some Australian fishing operators are also involved in fishing outside Australia. There are also cooperatives run by fishermen that wholesale and in some cases process the catch. However, most sales by fishermen are arms length transactions to local wholesalers, the main fish markets or to processors.

According to the last ABS wholesale establishment's survey in 1982, sales and transfers out, and turnover, for the 361 establishments designated as primarily engaged in fish wholesaling[2] were about $1 billion. Value added was $93.1 million. According to the ABS Integrated Register, in May 1986 there were 545 establishments listed with fish wholesaling as their primary activity.

With regard to New South Wales, the Master Fish Merchants' Association stated that the marketing system consists mainly of 'the broad based, centralised marketing system which accommodates over two thousand individual producers and sellers', and 'several large, vertically integrated companies - which represent a significant portion of the industry.' These two elements of the industry both seek to purchase fish, but they also specialise in particular types of fish for particular uses, for example sales as fresh fish to domestic restaurants and the public, or processing and export.

The centralised market system deals with the wide diversity of products supplied and sold by a majority of individual fishermen and merchants. The large wholesaling and processing companies can handle harvest gluts with their processing and storage facilities, and they dominate the sale of certain species which require specialist attention. Not all NSW fish pass through the statutory marketing system. It has been reported that from 20 to as much as 60 per cent is illegally sold outside the market.

In its submission, ABARE cited the results of a number of studies into the market power exercised by wholesalers at the Sydney and Melbourne fishmarkets. A study of the Melbourne market by SCP Fisheries Consultants and Kintill Stearns (1986) concluded that 'agents undoubtedly use their position to maximise their commercial advantage but this does not extend to being able to dictate prices and margins'.

The Victorian Government submitted that:

> In Victoria the Wholesale Fish Market is managed by the Melbourne City Council; there is only a small number of major traders. This means that there are only limited opportunities for the catching sector to negotiate on prices and to pass on costs.

The marketing of fish in Sydney was studied by SCP Fisheries Consultants and Ernst and Young (1989), who concluded that there was little evidence of organised market power and that there were enough buyers in attendance to maintain competition.

[2] Australian Industry Standard Code (ASIC) 4763

Evidence submitted by the City of Port Lincoln indicates that in their region there is a higher level of concentration at the processing and cold storage level than at the catching level. Several large fishing firms owned most of the town's cold storage capacity. These firms included the major cannery operators and fish processors. Some of them were fishermen's co-operatives.

Another example of different levels of market power is in exports to the Japanese prawn market. Prawn exports go to Japan through a small number of agents with connections in the Japanese market. On the Japanese market these exports compete with supplies from Thailand and other countries, and can only influence market price on a limited or temporary basis.

The BAE (1986) study mentions the possibility of firms in the input supplying sector having market power. However, this occurs mainly on a regional basis, and only for certain inputs. Only firms in small or remote locations are able to benefit significantly from any degree of concentration.

# APPENDIX F: RECREATIONAL FISHING

While the vast bulk of recreational fishing takes place in State jurisdictions, it is still important in a number of Commonwealth controlled fisheries. These include the Southern Bluefin Tuna, East Coast Tuna and South East Trawl fisheries. Recreational fishing is a major activity in the Great Barrier Reef Marine Park, which is a Commonwealth managed multi-use area but fisheries management is undertaken by Queensland agencies. Recreational fishing is also popular in the rivers of Kakadu National Park which is managed by the Commonwealth.

Recreational fishing is one of the most popular outdoor activities in Australia. It has been estimated that approximately 4.5 million Australians undertake at least one recreational fishing trip per year (PA Management Consultants 1984, cited in Recreational Fishing Advisory Committee 1990). Far fewer are considered to be dedicated, regular fishermen. The Australian Recreational and Sport Fishing Confederation stated that there are approximately 810 000 people in this category.

Recreational fishing is claimed to be a major attraction for a considerable number of overseas visitors to Australia. Research by the Bureau of Tourism Research indicates that in 1990 about 100 000 international visitors had fishing as one of their motives for visiting Australia and that they spent about $330 million. The data do not show how many come primarily to fish.

A very wide range of fishing modes are encompassed under the general activity of recreational fishing; for example, beach/headland/pier fishing, fishing in inland streams and water storages, fishing from private boats and fishing from hire/charter/game boats. Because fishing in Commonwealth waters only is of direct interest in this inquiry, not all these types of fishing activity are relevant. However, fishing in interconnected State waters is of interest where it indirectly impacts on Commonwealth fisheries.

Data are not available on an Australia-wide basis to indicate the number of fishermen undertaking activities in Commonwealth waters. While there is an estimate provided by the Australian Recreational and Sport Fishing Confederation, that 17 per cent of domestic fishermen fish in the 'open sea' (that is, 765 000 persons), this number cannot be taken as representing the numbers fishing in Commonwealth waters.

About 210 000 fishermen belong to clubs. This includes the clubs affiliated with the Australian National Sportsfishing Association which have a membership of about 100 000.

## Fish targeted

One important form of recreational fishing in Commonwealth waters is game fishing. The total membership of the Game Fishing Association of Australia, which has a particular interest in tunas and billfishes, is in the order of 9000.

A study was undertaken for the Bureau of Rural Resources (BRR) on recreational fishing for tunas and billfishes on the east coast of Australia (Kewagama Research 1990). It indicated that some 2900 yellowfin tuna and 600 marlin were caught and recorded in angling club events in 1988-89, mostly by gamefishing clubs.[1] A comparison of these figures and commercial catch figures for yellowfin tuna indicates that recreational fishermen account for some 25 per cent of the total catch. Most of the marlin were caught in north Queensland, and the yellowfin in more southern locations. Some of the yellowfin tuna is consumed on board as sashimi, or often consumed at home as barbecue steaks. Southern bluefin tuna is targeted by recreational fishermen, however, there are no available data on its extent.

Blamey and Hundloe (1991) found that of the 36 000 private motor boats registered in locations adjacent to the Great Barrier Reef, 90 per cent were used for fishing and/or crabbing, and 68 per cent were used for fishing in the Great Barrier Reef Region. The main species caught were coral trout, sweetlip, emperor, cod and mackerel.

[1] Gamefishing is recreational fishing undertaken in line with the ethics and rules of the Game Fishing Association of Australia (GFAA) and relevant state gamefishing bodies. Sportfishing is recreational fishing undertaken in line with the ethics and rules of the National Sportfishing Association (ANSA). In gamefishing competitions point scoring for captures focuses on a 'best fish' approach, with fish not being necessarily taken or weighed. Many fish are also released by sportfishing anglers without tagging, but the competition emphasis here is more on size and weight.

In the South East Trawl fishery recreational fishermen take significant quantities of whiting, flathead, mullaway, silver and blue-eyed trevalla and redfish. Shark are also targeted by recreational fishermen.

A significant proportion of visitors to Kakadu National Park go fishing for barramundi. In a survey undertaken in the early 1980s a third of respondents indicated their intention to fish while they were in the park.

## Conflicts between recreational and commercial fishing

Because recreational and commercial fishermen are to some extent sharing the same resource, conflicts can arise.

The Chairman of the Tasmania Sashimi Tuna Fishermen's Association (TSTFA), Mr. John Prokopice, said that there was considerable conflict with amateurs and charter boat operators in the fishery. He said that SBT caught by charter boats become the property of the charterers, even if they did not catch them themselves, and may be exported without SBT quota or a licence fee being involved. TSTFA said that charter boat operators, who charge their clients about $650 a day for a 10-person charter boat, are in direct competition with commercial fishermen. TSTFA claim that these fishermen catch some 30 SBT a day, 95 per cent of which are discarded or sold locally. There are 13 charter vessels operating down the eastern seaboard of Tasmania, six of which operate from Port Arthur. TSTFA stated that these charter boat operators advertise that they are going to catch SBT. One complaint by the TSTFA concerned one vessel in particular which caught SBT to mash up into burley for shark bait, instead of using less valuable types of fish; the sharks caught are left on the beach. Another was that at weekends there is considerable overcrowding and competition from recreational fishermen:

> ...the commercial fishermen at the moment virtually have got to tie their boats up on weekends. It is pointless going fishing on weekends. The influx of boats, I would say, over the last two weekends, there would probably be 60 to 70 boats in one area that is five miles long.

In the Southern Shark fishery there is some concern about the impact of recreational fishing on the gummy and school shark targeted by the commercial fishermen. In particular, it is believed that recreational fishermen in Tasmania who are entitled to use gillnets are damaging shark nursery areas. In other areas, shark are taken as incidental catches by recreational fishermen.

Recreational game fishermen have benefited from management actions, in particular the exclusion of commercial fishing in areas off Cairns and Townsville in Queensland. Dr Julian Pepperell, consultant to the Australian Fishing Tackle Association, discussed the exclusion of Japanese longline commercial fishermen from a fairly small area of waters off the Cairns region and its effects:

> It was really an area along the edge of the Barrier Reef between two points but only about a 50-mile band of water and here is another example of a line on water. Again there is a lot of controversy over whether the Japanese, after that, have ever...come in and fished inside that area.
>
> It (the closure) was designed to cut down on the catch of black marlin because that was the area where most of the Japanese catch of black marlin was taking place historically before that point. The Japanese of course have made the point that they have been fishing in that area since 1953 and they had a traditional right to the area and there were all sorts of political ramifications because most of the boats that fished in that area tended to come from one prefecture in Japan and that one prefecture would be disadvantaged by that closure.
>
> ...the Japanese were excluded from that area. That is renegotiable every year ... It is not a permanent closure and exclusion and in fact there have been some extensions to that closure recently. In fact I think even in the last round of negotiations they were excluded from an area off Townsville for similar reasons and...it was because of the benefits that were accruing from overseas anglers coming into the area.
>
> ...the number of marlin that were not being caught as a result of that closure was something of the order of 2000 or 3000 fish...each year but that was still only probably about 10 per cent of the total South-West Pacific catch of black marlin.
>
> ...black marlin are highly mobile and they do move freely throughout the South-West Pacific. There is now strong evidence that there was a big increase in the marlin population as a result of that particular closure.
>
> DPIE announced the closure off Townsville in December 1990, south of an existing area closure introduced in 1980 in which longlining is prohibited in waters between Cape Grenville and Townsville. The Minister for Primary Industries and Energy, Mr John Kerin, justified the closure on the grounds of its benefit to the tourist industry (DPIE 1990b):

> Government scientists report that in recent years around 60 percent of Japan's total east coast black marlin catch has come from this small area. Japanese longliners fishing in the Australian fishing zone mainly target tunas, but they also take significant numbers of marlins and other billfishes as a by-catch.
>
> Black marlin supports a major gamefishing industry in northern Queensland that attracts thousands of overseas visitors each year. The closure should significantly reduce Japan's by-catch of marlin and provide further protection of the gamefishing industry in the region.

Commercial interests, in particular charter boat operators and elements of the tourism industry, are users of recreational fishing grounds. Of specific interest to this inquiry is the operation of charter boat operators operating in Commonwealth waters. A particular instance of this is the game fishing charter boat fleet operating in the Great Barrier Reef Region. Hundloe (1985) states that persons undertaking charter trips caught at least 700 tonnes of fish in 1980.

Dr Thomas Bergin of the Australian Recreational and Sport Fishing Confederation also gave evidence of conflict between the demands of recreational fishermen and access by foreign fishermen. The demand by recreational fishermen for a moratorium on the commercial take of marlin throughout the AFZ was not taken up by Commonwealth fisheries managers because it could have created difficulties in the access negotiations with the Japanese Government.

Kewagama Research (1990) examined the charter boat side of recreational fishing in a project undertaken for the BRR, estimating that some 50 charter operations existed on the east coast, two-thirds of them in Queensland. Fifteen major ports and fishing areas were involved and there were eighteen minor ports and areas. The major base was Cairns. The charter boats take paying passengers for sport, game and other fishing activities.

The Game Fishing Association of Australia (GFAA) referred to the value of this activity to both the charter boat owners and tourism generally '...with the world coming to our doorstep to participate in the Black Marlin fishery off the Great Barrier Reef.' C. Olsson submitted that charter boat operators benefit from special access rights to the Great Barrier Reef, yet pay no licence fee or contribution towards fisheries management costs, even though they 'take a large amount of fish'. It was claimed that taking large numbers was not a problem as, according to GFAA, over 90 per cent of billfish caught by its members are tagged and released under the Game Fish Tag and Release Programme.

By conserving the resource through closures, TACs and other arrangements, fisheries management can confer benefits on recreational fishermen, tourists and charter boat operators through an increased strike rate. This can also make Australia a more competitive supplier of recreational fishing services compared to other countries. Dr Pepperell submitted that:

> ...the catch rate in Hawaii is very poor compared to the catch rate of marlin in Australia. That is why people come from the United States to Australia, because they are almost guaranteed a high strike rate.

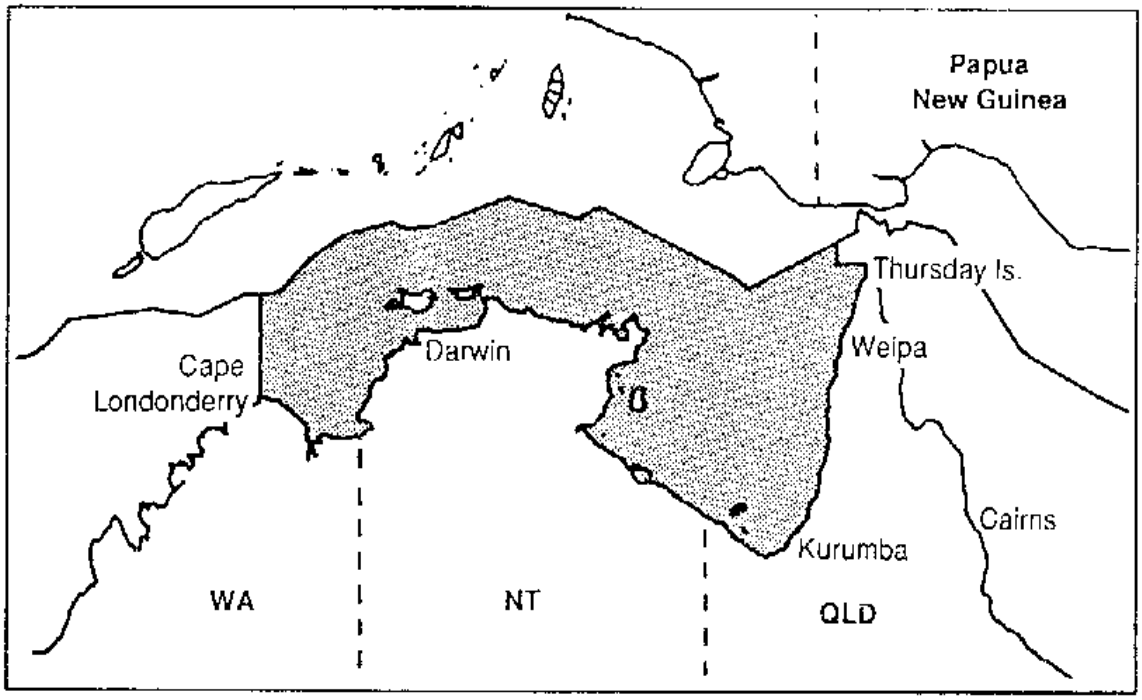
# APPENDIX G: MANAGEMENT OF INDIVIDUAL FISHERIES

## G.1 THE NORTHERN PRAWN FISHERY(24/12)

### Location

The Northern Prawn fishery (NPF) extends from Cape York in Queensland to Cape Londonderry in Western Australia, and covers an area of approximately one million square kilometres.

Map G.1: **The Northern Prawn fishery**



## Volume and value of catch

The fishery is one of Australia's largest both in terms of area and value of production. In the last three years the catch has been between 7000 and 10ÿ000 tonnes with a value of around $100 million. About 90 per cent of the fishery's production is exported, principally to Japan. Commercial trawling began in the mid 1960s after successful exploratory surveys undertaken by the CSIRO.

## Structure and catch methods

Boats in the NPF are otter trawlers. Compared with most other Australian fisheries the NPF is distinguished by the greater presence of large fleet operators. According to the AFS about 60 per cent of boats in the fishery are owned by operators with more than one boat (AFS 1989, p. 8) Furthermore, some companies are vertically integrated with the ship building, processing and marketing sectors.

Most boats operate out of Cairns, Darwin or Freemantle and tend to be at sea for months at a time. Processing involves freezing and packaging and is undertaken either on-board or at plants established locally such as those at Karumba or in other parts of the country.

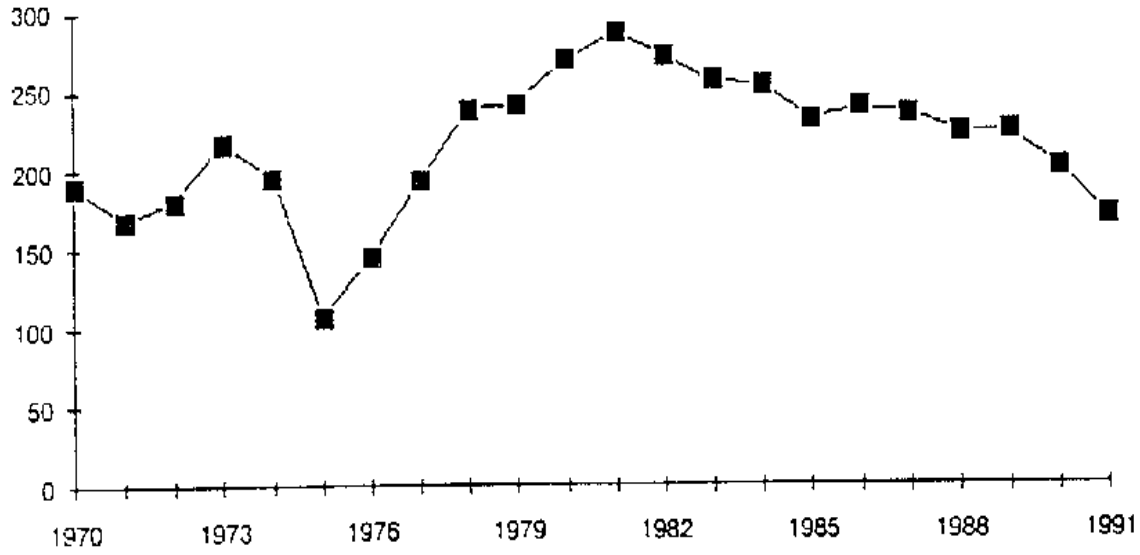
Excess fishing capacity is a major problem for the fishery. Numbers of boats grew dramatically during the 1970s. The fishing capacity of each boat has also grown as the boats became larger, faster and equipped with better gear. As indicated below, measures are in train to significantly reduce boat capacity.

## Markets and prices

After a long period of rising prices the industry has recently experienced a slump in prawn prices overseas, especially in Japan which is its major market. This has especially been the case for banana prawns that have been in direct competition with cultured prawns, the output of which has grown spectacularly in recent years. Consideration is currently being given to the feasibility of a promotion campaign in Japan to try to ensure a premium price for Australian banana prawns. The supply of Australian tiger prawns are considered to have some impact on the price in Japan because of their distinctive quality and size.

World prices have recently bottomed out and begun to rise, but the industry does not expect them to return to pre-1986 levels.

Figure G.1 **Boats operating in the Northern Prawn fishery 1970 – 1991**



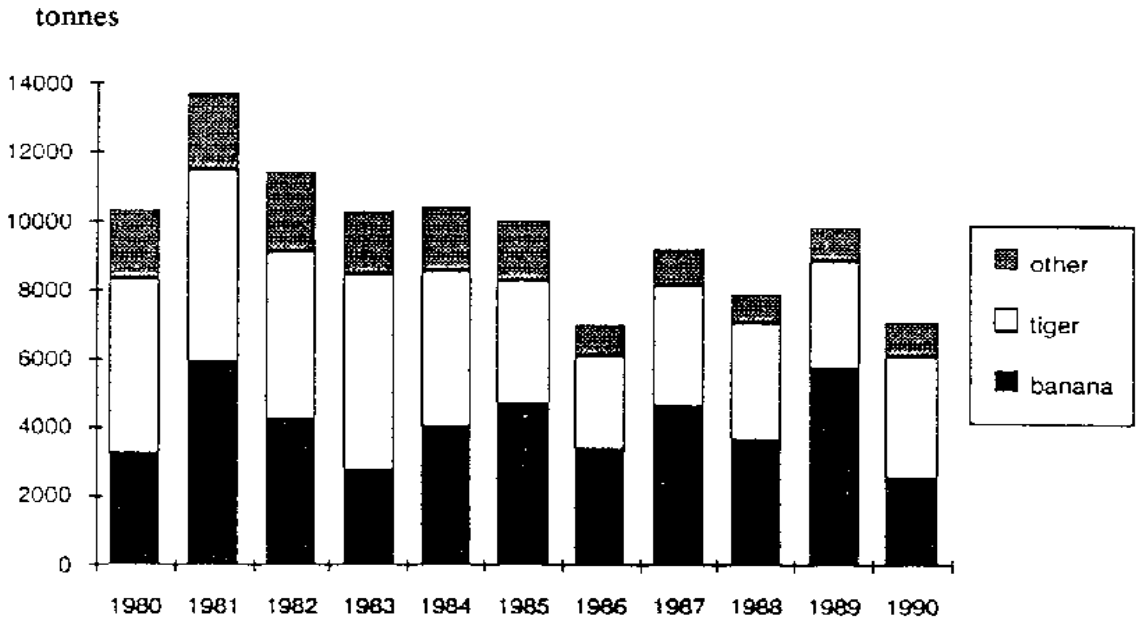

Source: Information supplied by AFS.

## Catch

The main species harvested are banana and tiger prawns. The banana prawn season commences in April. They are found in concentrated 'boils' and once discovered are very easy to catch. When banana prawn catch rates have declined sufficiently, fishermen switch to the other prawns, particularly the more elusive but more valuable tiger prawns.

Prawns live for no more than one to two years and have a high reproductive potential, with females producing up to half a million eggs per spawning. Prawn fisheries have generally been considered more resilient to fishing pressure than fisheries with longer lived species of fish with slow reproduction rates. However, the extent of this resilience is being increasingly questioned.

Figure G.2 **Trends in NPF catch 1980 - 1990**




Source: Information supplied by CSIRO.

Banana prawns have been fully exploited since the early 1970s but not necessarily overfished. Catches have been extremely variable in line with fluctuations in annual recruitment which is heavily affected by summer monsoonal rainfall. The higher the rainfall the more juvenile prawns that are washed out of the estuaries to the sea. In 1990 the catch was down to 2500 tonnes. However, in 1991 it jumped to around 7000 tonnes because of the high rainfall. This was the second highest banana prawn catch ever taken in the fishery. At the time of writing the summer rain has been unusually light. If this continues, the 1992 catch may prove to be very low. CSIRO has predicted a long term average catch of 4200 tonnes.

In the case of tiger prawns, fishing effort has had a significant impact on stocks. In 1986 CSIRO advised that the resource had suffered from recruitment overfishing and a substantial reduction in fishing effort was required if stocks were to recover.

## Management

*Jurisdiction*

Prior to 1988 the NPF was jointly managed by the Commonwealth, Northern Territory, Queensland and Western Australian Governments. Under the Offshore Constitutional Settlement (OCS) it became a Commonwealth fishery. Until 1977 management was essentially confined to seasonal closures. In 1977 an interim management regime was introduced that froze access to the fishery and set down restrictions on boat replacement.

The fishery is currently managed by AFS on advice from the Northern Prawn Fishery Management Committee (NORMAC) which draws its members from industry, CSIRO, state and federal governments and the AFS. Since 1989 the committee has comprised an independent chairperson, the manager of the Northern Prawn Fishery Section of AFS, four representatives from the prawning industry, a representative each from AFS and CSIRO, and one representative for the States adjacent to the fishery.

*Management methods*

Management controls on fishing effort is based on the following: limitations on boat numbers and size; permanent seasonal and daylight closures; and a limit of two nets per boat.

The number of boats operating in the fishery is restricted by what are known as class B units. Each boat requires one of these units to be entitled to fish. The size of boat permitted by each operator is restricted by the number of class A units held by the owner. These units are the sum of engine power in kilowatts and hull size in cubic metres.

Since 1986 boats could only be replaced if certain measures were taken to reduce capacity. A fisherman replacing a boat has to surrender a class B unit. This would require either purchasing another operator's class B unit or losing the entitlement to fish from a second vessel under the same ownership. Further the operator would have to surrender the number of class A units by which the new boat size exceeds 375 class A units. The operator would, therefore, have to acquire from someone else in the fishery substantially more class A units than he or she would require for the new boat alone.

The fishery is closed for two periods of the year. The summer closure is to allow the banana prawn stock to grow to its most valuable size before exploitation. The winter closure provides some protection to tiger prawn stocks prior to spawning. In addition, daylight trawling is banned during August, September and October to reduce fishing pressure on female tiger prawns which are thought to be more active than males during daylight. There are also seasonal and permanent closures of specified nursery grounds to protect juvenile stocks.

ABARE is currently undertaking a feasibility study of the applicability of ITQs for the fishery and will report by February 1992 (DPIE press release 15 March 1991).

ABARE will assess the likely effects of introducing ITQs in the northern prawn fishery using a dynamic model of the fishery. The model will be used to simulate the fishery under both ITQs and the present management measures which are based on input controls. The costs and benefits to the industry will be examined.

Management measures to restrict effort in the NPF have been criticised for having had the opposite effect. During the first three years of limited entry, 1977-79, fishing effort more than quadrupled. This was due in part to the fact that many fishermen from the Queensland east coast who only fished in the NPF for part of the year sold their rights to fish in the fishery and their boats were replaced by new, larger vessels that were dedicated full time to the NPF.

Attempts to constrain fishing effort were also undermined by the Commonwealth Government's ship bounty that encouraged the building of larger vessels that were eligible for the bounty.

*Surveillance*

The aim of surveillance in the NPF is to deter unauthorised operators and to monitor the operations of authorised operators to ensure that they conform to equipment and closure restrictions. Surveillance using patrol boats and aircraft is contracted to the Queensland Boating and Fisheries Patrol, and the Northern Territory Police.

A significant feature of the surveillance arrangements is the 'Le Mans' start to the banana prawn season. Under this system, which is designed to save money on surveillance costs, trawlers have to assemble 48 hours prior to the opening of the season in one of the five designated areas at Weipa, Karumba, Darwin, Gove and Groote Eylandt.

*Research*

The main institution undertaking research in the NPF is the CSIRO Division of Fisheries operating from its marine laboratory facilities at Cleveland near Brisbane. Its annual budget for NPF research is close to $1 million.

Since 1988 NORMAC has had a research committee that directs some of the applied research undertaken in the fishery. The committee comprises representatives from CSIRO, BRR, State Governments and the industry, and is funded by a levy on fishermen.

Communication of research findings is assisted by annual, CSIRO organised workshops in which scientists discuss their research findings with members of the fishing industry and fishery managers. Scientific advice has been employed on a number of occasions as the basis for major management decisions.

CSIRO was able to determine in 1974 that the banana prawn fishery was fully exploited. This prompted a number of studies on methods to stabilise or reduce access and investment in the fishery. This lead to the introduction of a limited-entry regime in 1977.

In response to CSIRO advice on potential increases in revenue-per-recruit from the banana prawn fishery, seasonal closures were lengthened in 1983 to a period of three months. Various controls on fishing effort were introduced in response to CSIRO advice in 1985 and 1986 that tiger prawn stocks had undergone a disturbing decline. These controls included the extension of seasonal closures, a maximum of two nets per boat and a ban on daylight trawling from August to October.

*Industry adjustment*

A buy-back system (the Voluntary Adjustment Scheme) was first introduced in 1985 in order to reduce fishing effort. It was funded by an initial Government grant of $3 million and an annual levy on fishermen. This financed the purchase of fishing rights from operators wishing to leave the fishery. Under this scheme class A and B units were purchased and then withdrawn from the fishery. The buy-back scheme had only limited success because the boats and units offered for sale were generally the less active or efficient boats in the fishery.

A new buy-back scheme is now in place which aims to reduce fishing capacity by 40 per cent by 1993. The 1990 level of 96 000 class A units (215 boats) is to be reduced to 50 000 class A units (about 120 boats) by 1 April 1993. The Commonwealth has provided a $5 million grant over the three year period and a loan guarantee of up to $40.9 million. These funds are being borrowed through the Queensland Fish Management Authority. Borrowings will be repaid over a ten year period by levies on unit holders who stay in the fishery. Initially the arrangements were as follows (DPIE press release, 7 March 1991):

> Unit holders who leave the fishery before 1 April 1991 will be paid a total of $950 for all active class A units assigned to their boat, and will be paid $450 for other units surrendered under the Management Plan. Unit holders leaving the fishery between 1 April, 1991 and 13 December, 1992 can receive $450 for all class A units surrendered. ... If the 50 000 target is not reached by 13 December, 1992, there will be a compulsory reduction of units across all unit holders in the fishery before the start of the 1993 fishing season.

In October 1991 the scheme was changed so that fishermen who elect to leave the fishery before 15 January 1992 will be paid $950 for any class A unit. They will also be entitled to continue fishing until the end of the 1992 season and will not have to pay adjustment levies.

The industry believes that reduction of units to 50 000 will significantly increase annual average catches and earnings per trawler. Based on 1989 catches, prices and costs, it has been calculated that restructuring would lead to the banana catch for the average trawler increasing by 46 per cent and tiger prawns by 100 per cent.

However, a key result obtained from the ABARE model of the NPF (ABARE 1988) was that a reduction in class A units would not necessarily lead to a reduction of fishing effort given that effort could still expand through increased fishing hours and adoption of more technically efficient capital. Gear restrictions are also limited in their effectiveness to the extent that they are nullified by improvements in technology and operators' skills.

**Financial arrangements**

According to current 1991-92 estimates, the total AFS management budget will be $1 155 200, of which administration accounts for $358 000, surveillance and compliance $458 000 and logbooks $261 800. Since 1989-90 the industry has paid 90 per cent of these costs.

This is collected by a levy of $17.40 per unit for fishermen with 375 units or less and $22.40 per unit if fishermen have more units. Of this $11.40 went to management cost recovery, $1.00 to research through the Fisheries Development Trust Account and $5 or $10 for the Voluntary Assistance Scheme.

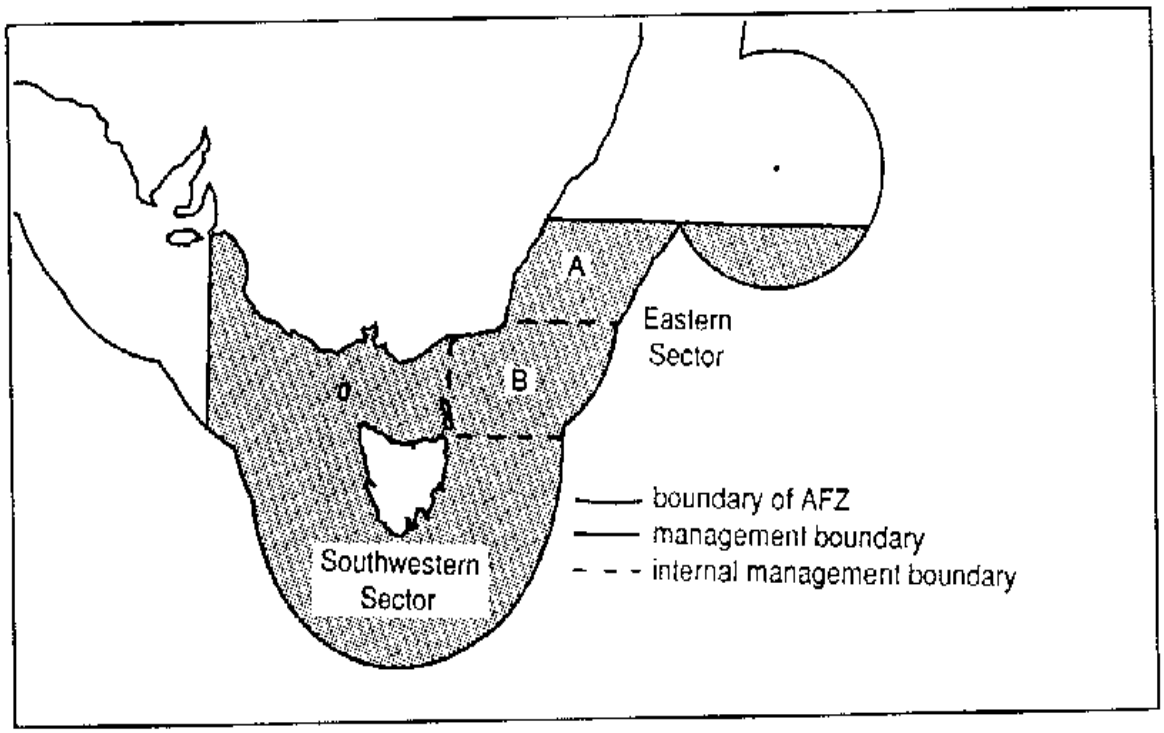
In the view of the NPF industry representatives there could be scope for savings through the use of non-government contractors for surveillance and compliance. They also felt that licensing and administration cost should be subject to a complete review.

# G.2 THE SOUTH EAST TRAWL (SET) FISHERY

**Location**

The South East Trawl fishery (SET) extends from Barrenjoey Point , north of Sydney, around Tasmania and west to Cape Willoughby in South Australia (refer Map G.2). There are three sectors within the fishery: the eastern sector regions A and B and the south west sector. The major ports are Hobart, Eden, Ulladulla, Lakes Entrance, Portland and Wollongong.

**Map G.2: The** South East Trawl fishery




*History*

The fishery was first exploited in the early 1900s. During the late 1970s and early 1980s many new boats were constructed to operate the fishery in response to improved profitability. This

improved profitability resulted from changes such as the transition from Danish seining to otter trawling which enabled a greater range of species to be exploited through extending the area of operations into deeper waters. Profitability also increased as more efficient trawlers exploited new resources. Since the early 1980s there has been a further expansion of fishing effort in the south-west sector of the fishery, stimulated by the development of the deep water fishery for blue grenadier, and later orange roughy. The first large aggregation of orange roughy was discovered off the west coast of Tasmania in 1986 and since 1989 in terms of total value of catch this species has formed the largest and most valuable portion of the total south-east trawl catch.

**Fishing methods and catch**

The main harvesting method is bottom trawling, but a small Danish seine fleet operates out of Lakes Entrance in Victoria.

Over ninety species of fish are harvested from the fishery, with the main ten species accounting for over 80 per cent of the total catch. Catches for the main species are given in Tables G.1 and G.2. According to ABARE preliminary estimates the value of the catch in 1990-91 was $70.6 million (ABARE 1991b).

The main markets for the fish caught are the United States, Japan and the Australian domestic market. The SET is the major source of fresh fish for the Melbourne and Sydney fish markets.

The number of vessels in each sector, noting that more than one endorsement may be owned by a single vessel, is shown in Table G.3. Therefore nominating a sector is a guide only as some multi-endorsed vessels may operate in each sector and others may only operate for part-time in the fishery as they may have other entitlements, for example, shark mesh netting, tuna longlining, otter trawl fisheries north of Barrenjoey or in the Great Australian Bight.

Table G.1: **Total catch (tonnes) for SET fishery main species - 1986 to 1990**

| *Species* | *1986* | *1987* | *1988* | *1989* | *1990* |
|---|---|---|---|---|---|
| orange roughy | 4 138 | 6 431 | 8 369 | 27 485 | 40 924 |
| gemfish | 3 584 | 4 768 | 3 754 | 1 862 | 976 |
| tiger flathead | 1 973 | 2 617 | 2 646 | 2 793 | 2 004 |
| blue grenadier | 1 422 | 2 185 | 2 104 | 1 896 | 2 171 |
| redfish | 1 713 | 1 293 | 1 106 | 750 | 759 |
| school whiting | 1 397 | 1 056 | 1 353 | 1 125 | 2 028 |
| jackass morwong | 980 | 1 143 | 1 529 | 1 749 | 962 |
| spotted warehou | 1 177 | 771 | 1 659 | 969 | 1 284 |
| blue warehou | 208 | 454 | 648 | 774 | 760 |
| pink ling | 719 | 799 | 617 | 716 | 613 |
| squid | 504 | 666 | 575 | 318 | 439 |
| mirror dory | 409 | 464 | 368 | 610 | 240 |
| john dory | 236 | 216 | 195 | 224 | 161 |
| ocean perch | 257 | 195 | 195 | 242 | 139 |
| silver trevally | 480 | 241 | 305 | 438 | 402 |
| royal red prawn | 16 | 31 | 148 | 328 | 234 |
| barracouta | 276 | 364 | 226 | 148 | 165 |
| jack mackeral | 489 | 172 | 1 179 | 20 | 12 |
| shark | 671 | 505 | 436 | 499 | 363 |
| other species | 2 522 | 1 698 | 1 780 | 2 031 | 2 563 |
| TOTAL | 23 171 | 26 069 | 29 232 | 44 977 | 57 199 |

Source: species landings - south east trawl logbooks

## Structure

### *Economic Analyses*

In March 1989 ABARE conducted an economic survey of the SET fishery (Geen et al 1989). Data on fishing costs and returns were collected from a sample of operators located throughout the fishery so that the financial performance of the industry in 1986-87 and 1987-88 could be estimated. This study is of limited applicability now because since 1987-88, the final year of the survey, there have been substantial changes in fishing costs and the prices received for SET fish. These were due mainly to the increased prominence of the orange roughy fishery. The projected effects of these changes on fishermen's incomes have also been estimated. Tables G.4 - G.6 present the economic and financial data which ABARE compiled during this analysis.

Table G.2: **Value of 1989 SET catch - based on mean price Melbourne/Sydney fishmarkets**

| *Species* | *Tonnes* | *$/Kg* | *Value($'000)* | *%* | *%-OR*[a] |
|---|---|---|---|---|---|
| O. roughy[b] | 26 931 | 1.90 | 51 169 | 62.6 | - |
| Gemfish | 1 663 | 2.78 | 4 624 | 5.7 | 15.1 |
| T. flathead | 2 420 | 1.28 | 3 098 | 3.8 | 10.1 |
| B. grenadier | 1 693 | 1.96 | 4 743 | 5.8 | 15.5 |
| Redfish | 601 | 1.28 | 769 | 0.94 | 2.5 |
| Whiting[c] | 1 092 | 1.88 | 2 053 | 2.5 | 6.7 |
| Morwong | 1 500 | 1.39 | 2 085 | 2.6 | 6.8 |
| Spt. warehou | 891 | 1.42 | 1 265 | 1.5 | 4.1 |
| B. warehou | 725 | 1.42 | 1 030 | 1.3 | 3.4 |
| Ling | 626 | 3.26 | 2 041 | 2.5 | 6.7 |
| Mirror dory | 543 | 1.56 | 847 | 1.0 | 2.8 |
| John dory | 193 | 2.68 | 517 | 0.63 | 1.7 |
| S. Trevally | 332 | 1.16 | 385 | 0.47 | 1.3 |
| Oc. perch | 190 | 3.52 | 669 | 0.81 | 2.2 |
| Barracouta | 124 | 0.98 | 122 | 0.15 | 0.4 |
| B.E. trevalla | 118 | 3.86 | 455 | 0.56 | 1.5 |
| R. R. prawn | 274 | 2.80 | 767 | 0.93 | 2.5 |
| Other sps | 2 637 | 1.92d | 5 063 | 6.20 | 16.58 |
| TOTAL | 42 546 | | 81 702 | | |

a) Percentage of total catch without orange roughy.

b) Export price only.

c) Export price unknown.

d) Mean for listed species.

Source: Australian Bureau of Agricultural and Resource Economics

Table G.3: **Boat numbers based in each SET sector**

| *Boat type* | *1986/87* | *1987/88* | *1988/89* | *1989/90* |
|---|---|---|---|---|
| Danish seiners | 25 | 21 | 24(a) | 26(b) |
| Eastern sector trawlers | 83 | 77 | 70 | 60 |
| South west sector trawlers | 40 | 40 | 46 | 48 |
| TOTAL | 148 | 138 | 140 | 134 |

a) two boats switched from trawling to seining.

b) two more boats gained access to the fishery as a result of reviews of initial licensing decisions by the Administrative Appeals Tribunal.

Source: Geen, G., Brown, D., and Pascoe, S., Restructuring the South East Trawl Fishery, paper presented at the Australian & New Zealand Southern Trawl Fisheries Conference 1990.

Table G.4: **South East Trawl fishery: catches, fishing effort and boat characteristics of the fleet and the survey sample (average per boat)**

| | *Boats (numbers)* | | *(units) Average boat sized* | | *(hours) Average effort* | | *(tonnes) Average catch* | |
|---|---|---|---|---|---|---|---|---|
| *Fleet sector* | *Fleet* | *Sample* | *Fleet* | *Sample* | *Fleet* | *Sample* | *Fleet* | *Sample* |
| 1986-87 | | | | | | | | |
| Danish seiners | 25 | 10 | 68 | 71 | 474 | 497 | 97.5 | 105.6 |
| Eastern sector trawlers | 83 | 30 | 122 | 110 | 623 | 620 | 122.7 | 115.7 |
| South-west sector trawlers | 40 | 18 | 199 | 183 | 427 | 440 | 315.7 | 333.7 |
| 1987-88 | | | | | | | | |
| Danish seiners | 21 | 10 | 73 | 71 | 518 | 535 | 46.7 | 120.7 |
| Easter sector trawlers | 77 | 34 | 127 | 122 | 571 | 660 | 130.4 | 121.5 |
| South-east sector trawlers | 40 | 14 | 218 | 197 | 534 | 498 | 292.0 | 302.6 |

Source: Geen et al (1989).

Table G.5: **Financial performance of the fleet in 1986-87 and 1987-88 measures (average per boat; in 1987-88 dollars)**

| | | *1986-87* | | | *1987-88* | | |
|---|---|---|---|---|---|---|---|
| *Measure* | *Unit* | *Danish seiners* | *Eastern sector trawlers* | *South-west sector trawlers* | *Danish seiners* | *Eastern sector trawlers* | *South-west sector trawlers* |
| Total returns[a] | $ | 143 911 (9) | 209 825 (7) | 456 741(13) | 146 890 (9) | 217 698 (9) | 543 187(11) |
| Total cash costs[b] | $ | 100 195(10) | 167 926 (8) | 393 630(11) | 112 140(10) | 195 329 (8) | 505 983(11) |
| Cash operating surplus | $ | 43 716(17) | 41 898(15) | 63 111(49) | 34 750(14) | 22 368(36) | 37 204(70) |
| Depreciation | $ | 9 706(16) | 16 725(22) | 29 332(25) | 9 487(15) | 17 671(27) | 49 789(27) |
| Interest payments | $ | 3 434(19) | 10 806(29) | 55 117(21) | 1 475(38) | 13 105(27) | 88 015(22) |
| Return to capital | $ | 34 009(24) | 25 173(25) | 33 778(88) | 25 263(20) | 4 697(160) | -12 85(-239) |
| Return to full equity | $ | 37 444(22) | 35 977(18) | 88 895(36) | 26 738(18) | 17 802(41) | 75 430(30) |
| Capital value of boat | $ | 126 368(13) | 249 528(10) | 756 294(12) | 123 907(13) | 293 278(10) | 839 143(15) |
| Rate of return to full equity[c] | % | +30(33) | +14(22) | +12(43) | +22(38) | +6(58) | +9(37) |

a) Net of sales commission and freight charges.

b) Where necessary, included an imputed payment to owner operators for their labour at rates comparable to their employed counterparts in the fishery. Interest payments are omitted from costs to enable full equity returns to be calculated.

c) Based on the capital employed in the boats. The values of licences and units are excluded.

Note: Figures in parentheses are standard errors expressed as a percentage of the survey estimate. These can be used to construct a range of possible values in which the census of fleet value may be located with 95 per cent probability. For example, total cash costs for Danish seiners in 1986-87 were estimated to be $100 195 with a standard error of 10 per cent. This implies that there is a 95 per cent probability that the population value of total cash costs would be within 2 x 10 per cent x $101 195 of the survey estimate - that is, between $80 156 and $120 234.

Source: Geen et al (1989, p. 46).

*Resource Rents in the SET fishery*

Although Geen et al (1990) showed that there are considerable potential rents under an ITQ system, their conclusions were conditional. (This is discussed later.)

Table G.6: **Projections of the financial performance of the fleet in 1988-89 (average per boat; in 1987-88 dollars)**

| *Measure* | *Unit* | *Danish seiners* | *Eastern sector trawlers* | *South-west sector trawlers* |
|---|---|---|---|---|
| Total returns | $ | 139 545 | 183 928 | 719 300 |
| Total cash costs | $ | 109 173 | 186 933 | 491 168 |
| Cash operating surplus | $ | 30 372 | -3 005 | 228 132 |
| Return to capital | $ | 20 884 | -20 676 | 178 343 |
| Return to full equity | $ | 22 359 | -7 571 | 266 358 |
| Rate of return to full equity | % | +18 | -3 | +32 |

Source: Geen et al (1989).

Campbell (1990) states that the mostly developed and overcapitalised state of the fishery indicates that most of the resource rent that may have once been available is likely to have been dissipated through either excessive fishing effort or through the costs operators have incurred, such as by the purchase of boat units, to participate in the fishery. He argues that under these conditions, if resource rent charges were introduced in the SET fishery, they would result in fishing operators making a loss and eventually being forced out of the fishery.

Campbell's solution to this underlying problem is to generate 'new' rent by introducing an ITQ system. By doing so a levy could be placed on any 'new' rent. This would be consistent with the Commonwealth's policy (Commonwealth 1989, p.27) that fishing operators should only pay resource rents on 'new' rents.

This is potentially complicated by the prospect that expected rents might already be capitalised. The new management regime and the associated restructuring has been foreshadowed for some time. Restructuring has been promoted on the basis of improving returns to those who remain in the fishery. The value of individual quotas could reflect these expectations. On the other hand, if there was the expectation that all 'new' rents were to be taxed away, this would be reflected in quota values.

## Past and current management

*Jurisdiction*

As it is a 'status quo' fishery part of the fishery, covering those waters within the stated area from 3 nautical miles off the coast to the limit of the AFZ, comes under Commonwealth jurisdiction, while those waters within 3 nautical miles of the shore are controlled by the relevant State.

Management advice to the Minister comes from the south east trawl management advisory committee (SETMAC) which consists of representatives from AFS, fishing authorities and industry in each of the four states affected, and a scientific representative.

*Management methods*

Prior to 1985, only two restrictions on fishing effort were in existence. They were:

- a minimum mesh size and an upper vessel length limit of 45.7 metres; and
- a prohibition on the operation of vessels longer than 32 metres in all areas of the fishery except waters west and south of Tasmania, except where a special endorsement was approved. If this was obtained then vessel length was allowed to reach 45.7 metres. Only 3 operators were allocated endorsements in this way.

In July 1980, the Commonwealth Minister for Primary Industry announced that limited entry into the SET fishery was being considered. In May 1982 an interim management plan was announced for the fishery, in which new entrants would not necessarily have long term rights to fish under a permanent management plan. In August 1984, a new management regime for the SET, including limited entry and endorsements, was announced. Endorsements are effectively sub-licences required for each of the sectors a fisherman wishes to fish. The new management regime was set to take effect in 1985. Applications for entry to the fishery and license endorsements were called for.

Because of the later announcement of an intention to introduce management arrangements in the south west sector, entry criteria were similar in intent, but different in detail, to those applying to the other sectors of the fishery, to accommodate the different circumstances. The Trawler Owners' Association of Australia (TOAA) reports:

> Entry into the Developing Zone (south-west sector) was far more lax and was principally dependant(sic) on an 'intention' to trawl. This led to a number of obsolete tuna poling vessels, for instance, entering the SET fishery on this more relaxed criteria. And quite a number of sunken vessels were resurrected, by way of unit replacement, that would otherwise have been left to rest in peace.
>
> Therefore there was an immediate blow-out in vessel numbers that certainly resulted in more than 100% additional capacity being injected into the SET fishery when the intention of course was the reduction of capacity.

In June 1985, a management plan was implemented, involving:

- limited boat entry;
- division of the fishery into two sectors, the south-west and eastern, with the eastern being divided into two regions A and B;
- separate entry criteria for the issue of endorsements for each area. Transferability of endorsements was permitted but only in conjunction with all endorsements/licences held;
- an interim boat replacement policy; and
- logbook program.

In effect, the fishery was closed to boats without a Commonwealth licence endorsed for one or more of the regions within the SET.

Although applications for endorsements were to close in December 1984, the fishery has not yet been closed to late applications. The last date for late applications was to have been March 1991. However, the applicable Management Plan was not tabled within the required time after gazettal. Consequently there are further delays in officially closing applications for entry into the fishery as the legislation did not come into operation. There are two operators currently appealling to the Administrative Appeals Tribunal (AAT) in an attempt to gain entry into the fishery. Should late applicants be successful in gaining entry into the fishery the total number of boat units in the fishery would be increased accordingly.

The placing of restrictions on the number of licences and endorsements made them valuable rights which are tradeable and therefore subject to capital gain/loss, and they added a new capital cost to fishermen entering, expanding or wishing to fish in regions for which they did not possess an endorsement. The extent of this change in capital value is illustrated in Table G.6.

The interim boat replacement policy prevented replacement of boats with greater under deck volume and engine capacity than the existing size. Danish seine boats were excepted in some cases. Logbooks were introduced to improve a database to enable the biological resource of the fishery to be monitored and improve management. Completion and provision of logbook returns became a condition for continuing access to the fishery.

In 1986, a new boat replacement policy, aimed at restricting and reducing fishing effort, was introduced. Under the scheme each boat was initially allocated a number of units if its licence was currently endorsed as eligible to be endorsed for the fishery. The number of units allocated to each operator was based on the dimensions of the boat and the power of the main engine. Fishermen wishing to replace or upgrade their boats had to purchase additional units, corresponding to the increase in capacity of their boat, from operators leaving the fishery. In addition to units matching the capacity of the new boat, extra units had to be purchased and subsequently forfeited to the government for removal from the fishery.

It is recognised by industry and management agencies that the boat replacement policy has failed to meet the objective of controlling fishing effort and capacity. This is because the required forfeiture of boat units has not been large enough to offset the aggregate effects of improving technology and the substitution by fishermen of inputs contained in the boat unit formula for inputs which are not. The inadequacy of the scheme is highlighted by TOAA:

> ... inefficient obsolete wooden vessels ... were converted into modern steel trawlers with vastly increased fishing capacity. The requirement to forfeit 20 per cent of units in order to bring about this conversion did little to make up for the increase in fishing capacity of these modern and generally much larger vessels.

As the boat units were also able to be traded they too acquired a market value and therefore added to the capital cost of entering the fishery or upgrading.

In summary, the most significant management controls currently in place in the SET are:

- limited entry, with access to areas of the fishery via endorsements;
- TACs for gemfish and orange roughy;
- trip limits for blue eye trevalla;
- ITQs for gemfish;
- boat length restrictions;
- unitisation of the fleet and boat replacement policy; and
- minimum mesh size.

As the licence endorsements are transferable they can account for a significant portion of the operator's investment. In 1989 demand for endorsements in the south west sector escalated due to the decline of the gemfish fishery in the eastern sector and the discovery of the St Helens orange roughy aggregation in the south west sector. The effects of the increased demand for south west sector endorsements (on nominal price) can be seen in Table G.7

Table G.7: **Change in unit and endorsement values (1986-1991) - South west sector**

| | *Units ($ value)* | *Endorsements ($ value) South west sector* |
|---|---|---|
| 1986 | 700 | 15 000 |
| 1987 | 1 500 - 2 500 | 100 000 - 150 000 |
| 1988 | 3 000 - 3 500 | 100 000 - 150 000 |
| 1989 | 3 750 - 4 000 | 200 000 |
| 1990 | 3 500 | 150 000 |
| 1991 | 2 700 | 150 000 |

Source: SETFIA Submission.

*Management costs and revenues*

The AFS budget for the SET fishery (Table G.8) shows the break down of total costs between administration and licensing, surveillance and compliance, the logbook program and other external costs.

The move towards compliance with the current Commonwealth policy of collecting 90 per cent of management costs can be seen in Table G.9

*Surveillance*

The New South Wales Department of Agriculture, the South Australian Department of Fisheries, the Tasmanian Police, and the Victorian Department of Conservation and Environment all provide surveillance for the SET fishery. These departments are reimbursed for the cost of the surveillance by the AFS. The Tasmanian police provide surveillance for Commonwealth waters around Tasmania. The vessel 'Tasmanian Enterprise' was chartered by the Tasmanian police from November 1990 to May 1991 for this purpose. In addition, this vessel was used by Commonwealth observers for transfers to foreign fishing vessels. Aerial controls are conducted in conjunction with the sea controls.

*Research*

Scientific advice comes from the Bureau of Rural Resources (BRR), CSIRO and State departments.

Table G.8: **South-East Trawl fishery Budget 20 March 1991**

| | *Anticipated Expenditure 1989-90 $* | *Estimated Expenditure 1990-91 $* |
|---|---|---|
| **Administration and Licensing** | | |
| SA Department of Fisheries | 1 500 | 0 |
| NSW Department of Agriculture | 16 548 | 0 |
| Vic Department of Conservation and Environment | 5 690 | 0 |
| Tas Division of Sea Fisheries | 10 405 | 0 |
| Department of Primary Industries and Energy | 210 892 | 142 554 |
| *Total Administration and Licensing* | 245 035 | 142 544 |
| **Surveillance and Compliance** | | |
| SA Department of Fisheries | 21 400 | 25 000 |
| NSW Department of Agriculture | 61 154 | 64 212 |
| Vic Dept of Conservation and Environment | 75 431 | 52 358 |
| Tas Enforcement | 16 003 | 37 717 |
| Tas Division of Sea Fisheries (orange roughy) | 43 720 | 0 |
| Contingency item for unplanned enforcement/surveillance | 0 | 25 000 |
| Department of Primary Industries and Energy | 18 431 | 56 290 |
| *Total Surveillance and Compliance* | 236 139 | 260 577 |
| **Logbooks** | | |
| Vic Department of Conservation and Environment | 35 410 | 33 195 |
| Tas Division of Sea Fisheries | 11 889 | 10 070 |
| NSW Dept of Agriculture | 13 254 | 37 860 |
| Department of Primary Industries and Energy | 149 142 | 156 551 |
| *Total Logbooks* | 209 695 | 237 676 |
| **Other External Costs** | | |
| NSW Trawl Fishery Program | 93 550 | 57 000 |
| Central Ageing Facility | 23 796 | |
| *Total Other External Costs* | 93 550 | 80 796 |
| Less licence fees | 7 200 | 0 |
| **Total Costs** | 777 219 | 721 603 |
| *90% of Total Costs* | 699 497 | 649 442 |
| *Add:* | | |
| SETMAC Industry Member's Costs (100% recoverable) | 10 902 | 15 000 |
| Independent SETMAC Chairman and Secretariat | 0 | 25 000 |
| Less: | | |
| Carryover From Previous Financial Year | 26 581 | 31 047 |
| **Total Management Levy Base** | 683 818 | 658 395 |
| Cost Per Unit (1990/91) based on 24 000 units | | $27.43 |
| Revenue Collected (1989/90) | 714 865 | |
| Carry Forward for 1989/90 | 31 047 | |

Source: AFS (1991)

Table G.9: **Management levies and proportion of cost recovery**

| | | *General levies* | | *Species levies* | | | | *All levies* |
|---|---|---|---|---|---|---|---|---|
| | | | | *Gemfish* | | *Orange roughy* | | |
| *Year* | *Rec'd* | *$/unit* | *Total ($)* | *$/unit* | *Total ($)* | *$/unit* | *Total ($)* | *Total ($)* |
| 87/88 | 60% | 27.90 | 669 600 | | | | | 669 600 |
| 88/89 | 75% | 32.56 | 781 440 | | 75 000 | | | 856 440 |
| 89/90 | 90% | 30.14 | 723 360 | | 236 250 | 5.82 | 84 390 | 1 044 000 |
| 90/91 | 90% | 27.43 | 658 395 | | 230 584 | 17.89 | 295 237 | 1 184 216 |

Note: Amounts collected in 87/88, 88/89 and 89/90 are approximate only. The levies for 1990/91 are proposed figures only.

Source: SETFIA submission.

**Management of individual species**

The only species in the SET subject to specific regulations are orange roughy, gemfish, blue eye trevalla and, in the near future, jack mackeral.

*Orange roughy*

Orange roughy is a deep water species presently caught in waters extending from off NSW to the western part of the Great Australian Bight (GAB), therefore that fishery overlaps the SET fishery. The first spawning aggregation was discovered in May 1989 off St Helens on the east coast of Tasmania in the south west sector. Feeding aggregations off the east and west coasts of Tasmania and western Victoria have been fished since 1986. Since 1989 feeding aggregations off Maatsuyker and Pectra Branca Islands (south of Tasmania) have yielded very large quantities of orange roughy (24,000 tonnes in 1990). In the short term the orange roughy fishery has been the most valuable in the SET with landings valued at about $50 million in 1989. The current high

return from the fishery is expected to be short lived. This is because the slow growth rates of the fish indicate that the maximum sustainable yield (MSY) is a small fraction of the current yield. The current yield is so high because the virgin biomass is being fished down. Large catches can be taken during the fish down to the optimal sustainable level without threatening the stocks. However, once the optimal sustainable level is reached a level of catch must be taken which does not reduce the stocks any lower.

The reason why returns are so high during the fish down of virgin stocks and why the stocks are so susceptible to over-exploitation is because they form extremely dense spawning aggregations at the same location and at approximately the same time each year (for 1989 and 1990 at least), and the fish are extremely slow growing. Feeding aggregations are far less predictable. However about 55,000 tonnes of 87,348 tonnes (63 per cent) of orange roughy landed from SET between 1986 and 1990 were from non-spawning aggregations. Sixty six boats are endorsed for the SW sector of which, in the 1990 season, up to 48 trawlers fished the 'hill' off St Helens in comparison to a total of 40 vessels based in the south west sector in 1986/87. This represents a significant increase in numbers of vessels and an even greater increase in fishing power as many existing and new vessels became equipped for deep sea trawling.

The orange roughy fishery is regulated by competitive area TACs. They are competitive because there are no controls over what portion of the TAC each vessel is allowed to take. This promotes a race for the catch which may lead to the inefficient production of fishing effort. The TACs are complemented by closures of the catching season. This is in addition to the overall regulatory mechanisms operative in the SET.

*Gemfish*

Gemfish occur in shelf/slope waters throughout the SET. Catches from the winter spawning run up the east coast account for a large portion of the total SET gemfish catch. Whether or not the gemfish east and west of Bass strait are separate stocks is not yet known and determining this is considered to be a research priority. Regulation is by TAC and proportional ITQ for eligible trawlers. This is again in addition to the overall regulations for the SET fishery.

The TAC for the 1988 and 1989 seasons was set at 3000 tonnes. For 1988 it was a competitive TAC. In December 1988, ITQs for the 1989 gemfish season were announced. The 1990 TAC was reduced to 1750 tonnes as a consequence of both scientific advice and fishermen being able to catch only 2000 tonnes of the 3000 tonne TAC in 1989.

Current scientific advice from the Demersal and Pelagic Fisheries Research Group (DPFRG), which provides advice to SETMAC, suggests the gemfish stock should be able to support a sustainable harvest of between 3500 and 4000 tonnes if the stock is allowed to recover.

The level of biomass at the beginning of the 1990 season would normally allow a TAC of 2500 tonnes to be set. However, advice from the DPFRG that the cohort of 4 year olds was missing from 1989 samples led to a 30 per cent decline in exploitable biomass. This led to a TAC of 1750 tonnes being set for 1990. The DPFRG stated that should the missing cohort appear in 1990 catches this would allow the TAC to be increased mid-season. A gemfish liaison committee was established to discuss ways of facilitating the intensive sampling process and it was agreed to station biologists at Ulladulla and Lakes Entrance at the beginning of the season to sample the stocks. Sampling indicated the situation was worse as a proportion of both 5 year old and next year's 4 year old gemfish was less than expected from normal recruitment.

The 1991 TAC is 420 tonnes. This small TAC has led to the cessation of gemfish targetting as the full amount is likely to be caught as by-catch.

In 1991 scientific advice was to set a zero TAC. However it was recognised that a by-catch would be caught. A 500 tonne TAC was set to cover all fishing methods for the whole year.

*Blue Eye trevalla*

AFS has imposed a 500 kg trip limit per boat on blue eye trevalla in order to protect stocks from a number of trawlers which are capable of targeting the species. Until recent times most of the fish have been caught by dropliners. This method ensures that the quality of the catch is high and places low pressure on the stocks in comparison to trawling. There has been conflict between those trawl fishermen who have fitted midwater trawling equipment to allow them to target blue eye

trevalla and the traditional dropliners. An attempt was made to achieve an industry resolution to the conflict through a memorandum of understanding (MOU) between the two groups. Final endorsement of the industry MOU did not eventuate, but industry representatives agreed that fishing effort should not exceed historical levels until research into the biology of the species is undertaken. Funding for this research has been made available through the Fishing Industry Research and Development Council (FIRDC).

*Jack mackeral*

In July 1990 the Australian Fishing Council (AFC) determined that a plan should be prepared for the jack mackeral fishery, following a report of an AFC Jack Mackeral Working Group. This fishery is not currently subject to either a Fisheries Act notice or any other management arrangement, although the 1989-90 catch was estimated to be 12 400 tonnes, with a value of $1.8 million. The Jack Mackeral Working Group is now developing a management plan which, in time, is expected to be gazetted.

**Recent developments**

*Future management proposals*

In response to the failure of the boat replacement policy, a working group was formed in 1988 to identify alternative management policies for the fishery. Four options were formulated (see Table G.10). This situation encouraged ABARE to model the fishery in an endeavour to investigate which option was the best.

Table G.10: **Main features of proposed management options**

| *Option 1* | *Option 2* |
|---|---|
| More stringent 2-for-1 boat replacement policy across the whole fishery. Boats with dual endorsements can operate in both sectors.<br><br>Individual non-transferable quotas on some species; orange roughy, blue grenadier, gemfish.<br><br>Possible buy-back of licences. | Different boat replacement policy for each sector; 2-for-1 in west, current arrangements in east.<br><br>Individual non-transferable quotas on some species: orange roughy, blue grenadier, gemfish. |
| *Option 3* | *Option 4* |
| Individual transferable quotas for all major species across the whole fishery.<br><br>Disband input controls except minimum mesh size. | Division into two fisheries along the boundary between eastern and south-west sectors. Boats must choose which side to fish on.<br><br>More stringent 2-for-1 boat replacement policy in eastern sector.<br><br>Licence buy-back in eastern sector. |

Source: Geen et al (1990).

Geen et al (1990) concluded that ITQs would clearly be the best option in terms of generating resource rent. However, these conclusions were conditional on enforcement and monitoring costs being lower than the difference between the gains from ITQs and the next best option. Monitoring and enforcement costs were not quantified. The findings were also conditional on the 1989 orange roughy catch of 15000 tonnes being maintained. This is a grossly over optimistic assumption given the characteristics of the orange roughy fishery. Despite the conditional nature of the study's findings it has now become government policy that ITQs will be phased into the SET in the 1990-92 period, with priority given to the introduction of ITQs for gemfish, redfish, flathead, morwong and whiting. The Minister for Primary Industries and Energy has announced that the introduction of ITQs is planned for these species in 1991, and that species such as orange roughy and blue grenadier could be included in the regime the following year.

The Quota Implementation Team was formed by the AFS in June 1990 principally to develop a framework for introducing the ITQ system. The team has to identify and develop the eligibility criteria. TACs have to be set for the species that are going to be managed under an ITQ system. The infrastructure for operating and monitoring the ITQ system, including the legal and physical arrangements, has to be developed and tested.

The team recognise that catch histories, investments, marketing trends, and effects on marketing will all have to be taken into account in determining how quota will be allocated. Possible regional effects will also be considered. It is recognised by the AFS that there are a number of difficulties to overcome, including by-catch problems, 'highgrading', and developing accurate and efficient monitoring systems. Highgrading is the discarding of low value catch to increase the value of the vessel's limited total catch.

A formula for the initial quota allocation will be developed by the team. This will be done partly on the basis of catch history and investment. To avoid further overcapitalisation, the Minister for Primary Industry and Energy has announced that this formula will not take into account catch histories after 31 December 1989, or any further investment in the fishery after 31 July 1990. He also said that any logbooks submitted after 31 July 1990 would not be used to calculate catch history, even if they related to the period prior to 31 December 1989.

*Industry Attitudes to ITQs*

Industry has reservations about the introduction of ITQs. These reservations are due to concerns about:

- highgrading;
- dumping of by-catch;
- further overfishing and overcapitalisation in the periods prior to the introduction of ITQs as operators endeavour to enhance their catch histories;
- uncertainty that the TACs will be sustainable;

- adverse social effects, as the reduction in vessel numbers may severely affect some local fishing communities;

- the need to purchase quota units from other fishermen is seen as seen as `double investing' because fishermen have already invested in the fishery;

- increased enforcement and monitoring costs; and

- loss of `intrinsic benefits' from competing for catch.

Some members of the industry are of the opinion that it is far from clear whether the ITQs are the best approach for the species in the south west sector and in the Danish seine fishery (Thomas 1990). It is conceded by industry that ITQs were required for gemfish in the eastern sector to cope with the stock problem. Industry also accepts that biological problems would justify the implementation of ITQs for redfish and morwong.

Establishing sustainable TACs was considered by Thomas (1990) to be a major problem when considering the introduction of ITQs into the SET. This is primarily because major restructuring is implicit in the move to ITQs. The level of restructuring which would occur if an ITQ system replaced the current management regime has been quantified by Geen et al (1990). They estimate that the number of vessels operating in the south-west sector would decrease from 48 to 11. This would involve a considerable amount of trading in the market for quota units. Investing in this asset on the basis of its estimated returns in perpetuity requires knowledge about future TACs. However, for most species in the SET the current biological knowledge is insufficient to allow for the setting of optimal long term TACs. Industry fears that amongst this uncertainty the inherent optimism of fishermen will cause some operators to base their investment decisions on the basis of too high a TAC, as was the case in the Southern Bluefin Tuna fishery. This may result in capital losses for those who purchase quota and abnormal gains for sellers. The present practice of `grandfathering in' those who now have access rights to the fishery will provide a windfall gain for these fishermen, but they are concerned about the Commonwealth policy of recovering some of the `new' rents. What these concerns illustrate is the great difficulty managers face in getting acceptance to new management regimes, particularly those involving restructuring.

# G.3 SOUTHERN SHARK

## Location

The Southern Shark fishery extends from waters adjacent to Victoria, South Australia, around Tasmania and out to the edge of the continental shelf (refer Map G.3). The principal species caught are gummy shark and school shark. Other species caught include common saw shark, southern saw shark, elephant fish, and angel shark.

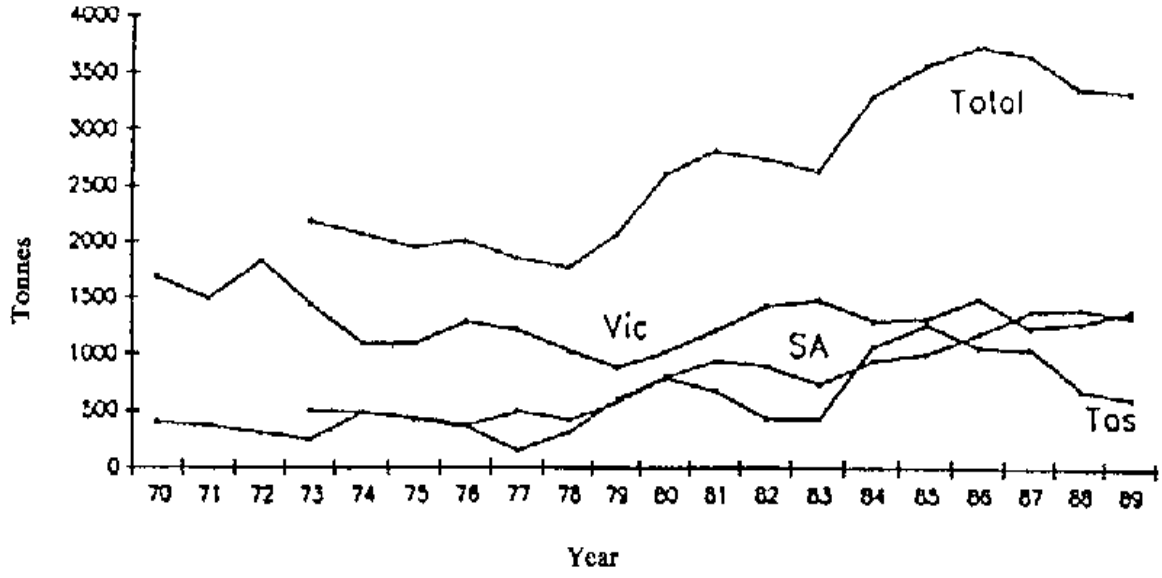
## Volume and value of catch

The catch for gummy and school shark steadily increased from 2073 tonnes, carcase weight, in 1979 to a peak catch of 3754 tonnes in 1986. Current estimates indicate a declining catch since the 1986 peak (refer Figure G.3). According to ABARE preliminary estimates the 1990-91 catch for all species was 2600 tonnes and the landed value was $12.4 million (ABARE 1991b). This includes the value of production from Commonwealth and State waters.

Map G.3: **Map of Southern Shark Fishery**

Source: AFS.

Figure G.3: **Gummy and school shark catch (carcase weight) by State and total for 1970 to 1989**




Source: Walker and Gason 1990, Summary of Shark Catch and Effort Data for Victoria, Tasmania and South Australia during 1979-89, Background Document presented to the Sixth Southern Shark Assesment Workshop, 19-21 November, Queenscliff, p. 7.

Although catch has been steadily increasing until recently, scientists have been warning of a declining population and forecasting a dramatically large fall in catch. Fishermen believe that scientists are not correct in their estimates. For instance, Mr Atterton of Port Lincoln submitted that there are large numbers of shark off the continental shelf which could be exploited.

### Structure and catch methods

Commercial catches of shark were first recorded in the mid-1920s. The fishery was based on the longlining technique. In the 1960s, there was rapid growth in the fishery as the market for shark fillets expanded and gillnets were introduced. By 1989, longlining accounted for only 15 per cent of the total catch, compared with 100 per cent in the early stages of the fishery. With this change in fishing method came an associated decrease in the proportion of school shark compared to the proportion of gummy shark in the catch (refer figure G.4).

Currently monofilament gillnets take more than 85 percent of the catch, longlines account for about 10 percent and the balance is taken by other methods including snapper longlines, inshore multifilament gillnets, beach seines, trawl nets, drop lines and hand lines. Generally a 6-inch mesh is used by Victorian and Tasmanian fishermen operating in Bass Strait where smaller sharks are caught, while 7-inch mesh is generally used by fishermen operating off the South Australian coast. Most gillnet fishermen favour restricting effort in the hook fishery however hook fishermen propose that no controls be introduced on the hook sector of the fishery but a ban be placed on gillnets.

There is interdependence between fishing effort in the shark, scallop and rock lobster fisheries as most fishermen have access rights to at least one other of these fisheries (Commonwealth of Australia 1989, p. 51). Rock lobster and scallop fishermen target shark when the catch rate in their main fishery is poor or during closed seasons. Many fishermen view these fisheries as one diversified fishery with their income dependent on fishing for more than one species.

Shark is taken as a by-catch in the trawl fishery, in the trevally and trevalla fisheries and the inshore net and hook fishery, and by recreational fishermen (Campbell, Battaglene and Shafron 1991). The size of this by-catch has not been ascertained and the extent of the recreational catch is not known.

A recent controversy arose concerning Japanese longline tuna vessels taking large numbers of pelagic shark in Commonwealth waters off Western Australia and Tasmania. However, it is unlikely that these fishermen would be targeting school or gummy shark, as those are demersal sharks and the fins from these species are small and do not have a high commercial value. Nonetheless, the reports alleged that certain Japanese operators are taking up to 1000 pelagic sharks per night in Commonwealth waters off Tasmania. A catch of this size may have an impact on the pelagic shark population but not the demersal shark such as school and gummy shark.

### Markets and prices

Shark supplies the domestic market for fresh fillets. It is not exported. The main domestic market is Victoria and to a lesser extent New South Wales. It is sold fresh as 'flake' in retail outlets and cooked in fish and chip shops.

Shark has a relatively high value compared to some other fish. In February 1991, the landed price for shark was approximately $4.60 per kilogram. The July 1991 landed price was reported to have been as high as $7.50 per kilogram for premium fish. The increase in price is possibly due to a scarce supply as the interim arrangements to reduce effort took effect. Hook caught shark may receive a quality premium of up to $2 per kilogram over gillnet caught shark. Smaller shark is considered better quality and also obtain a premium price.

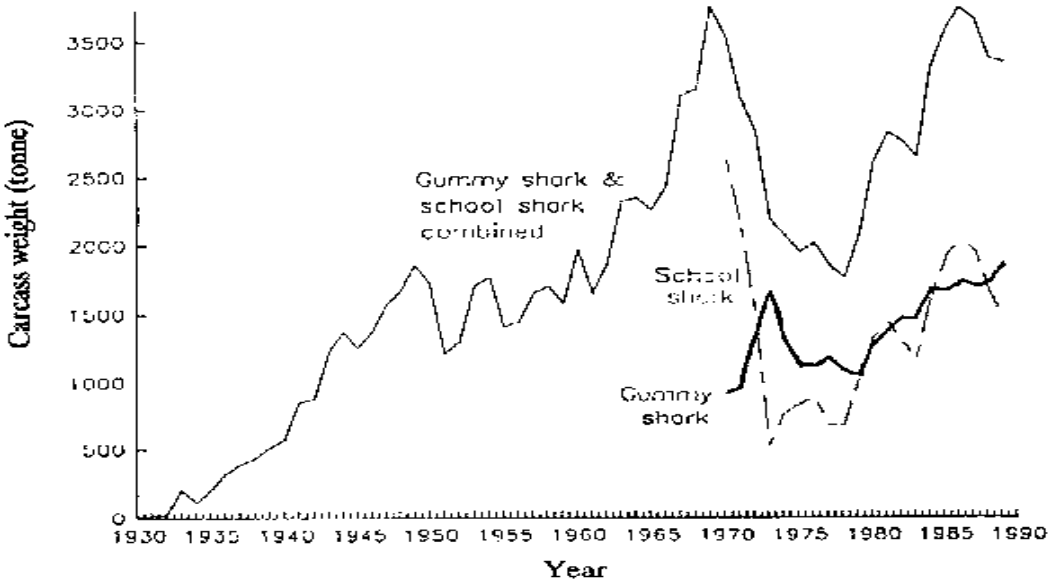
Some fishermen export dried shark fins to Asian markets, although quantities are small. Some reports indicated that the wholesale price in Asian markets is about $US 117 per kilogram. However, one Australian exporter indicated that it pays between $20 and $30 per kilogram for dried fins depending on species and size of the fin. AFS regularly receive inquiries from exporters seeking potential suppliers of large sharks for shark skin and fins.

## Catch

Prior to 1950 the fishery was confined to Bass Strait. The fishery has expanded since then to the extent that present fishing effort targets almost all of the known shark stocks. This expansion in the area of the fishery offset falling catch rates in the established areas. Prior to the 1960s the fishery was based on longlining techniques and annual catch increased gradually (refer Figure G.4). In the 1960s the introduction of monofilament gillnets contributed to a rapid increase in catch (Tilzey 1990, Southern Shark Newsletter, No. 8, January 1990) reaching a peak in 1969.

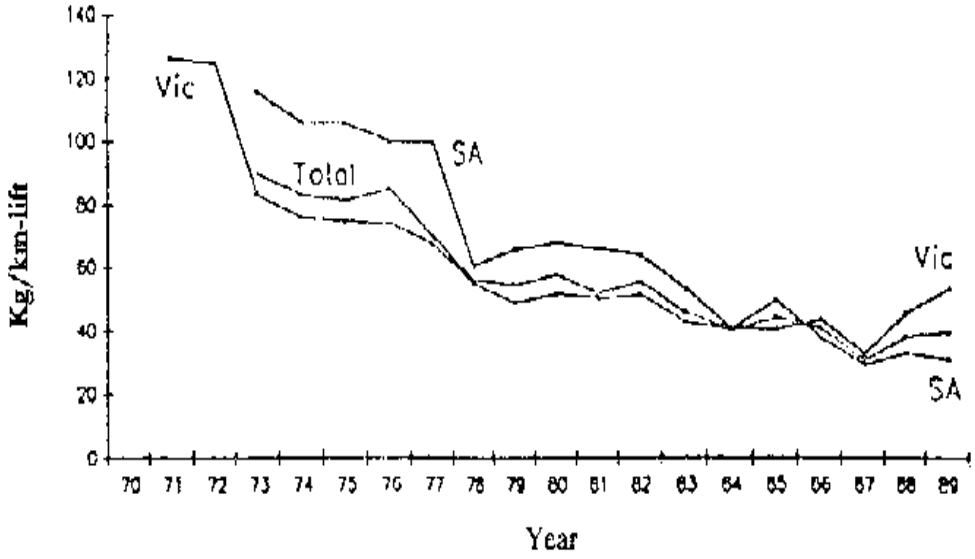
By the early 1970s the fishery had become overfished and the catch declined. From 1978, recorded catches began to climb back to the 1969 level. However, this increase required more effort and greater use of more efficient technology. It took three times the fishing effort in 1987 to catch the same amount of shark as it did in 1971 (Figure G.5). With the use of navigational aids and rear-mounted net drums, 'effective fishing effort' increased (although this is not reflected in measures of effort measured in number of 'net lifts' based on net equivalents), resulting in higher catches.

Figure G.4: **Production of gummy shark and school shark from southern Australia during 1930-89**




Source: Walker and Gason 1990, Summary of Shark Catch and Effort Data for Victoria, Tasmania and South Australia during 1979-89, Background Document presented to the Sixth Southern Shark Assesment Workshop, 19-21 November, Queenscliff, p. 6.

Figure G.5: **Catch per unit effort for 1970 to 1989**




Source: Walker and Gason 1990, Summary of Shark Catch and Effort Data for Victoria, Tasmania and South Australia during 1979-89, Background Document presented to the Sixth Southern Shark Assesment Workshop, 19-21 November, Queenscliff, p. 7.

The biology of sharks makes them extremely vulnerable to fishing effort. Sharks generally take 7 to 15 years to reach sexual maturity, depending on species. Most species reproduce only once every two years, and pregnancy lasts a year. High infant mortality rates, 12 per cent for school shark and 15 per cent for gummy shark, and exceeding 50 per cent for some species, makes it difficult for sharks to maintain their numbers under high fishing effort.

A number of factors during the 1960s and 1970s resulted in gummy shark becoming the dominant species in the catch (Figure G.4). The low legal minimum size restriction on school shark in Victoria resulted in greater numbers of immature school sharks being taken and therefore fewer school sharks reaching sexual maturity. The introduction of gillnets led to increased catches of gummy shark.

*Status of the fishery*

Biomass estimates by the BRR indicate that the combined gummy and school stocks may now be at 15 per cent of the virgin biomass level (refer Table G.11). This is far below the optimal population size, where growth rate and therefore sustainable yield, is maximised, which is estimated at about 50 per cent of the virgin biomass for this species.

Table G.11: **Biomass estimates**

| *Stock* | *Biomass - carcase weight* | | *1990 stock as a proportion of virgin biomass* |
|---|---|---|---|
| | *1930* | *1990* | |
| | *tonnes* | *tonnes* | *per cent* |
| School | 41 000 | 6000 | 15 |
| Gummy | 20 000 | 3000 | 15 |
| Total | 61 000 | 9000 | 15 |

Note: These estimates are based on the computer model of the fishery, SHARKSIM, which is discussed below

Source: Reichelt and Tilzey (1991).

Reichelt and Tilzey (1991) conclude that the sustainable annual yield from the present combined stocks of school and gummy shark is between 500 tonnes and 800 tonnes. However, the sustainable yield is the amount which can be harvested without altering present stock levels and makes no allowance for stock recovery. Furthermore, no allowance for risk assessment has been made, particularly that of recruitment failure. Walker (1991, p. 4) warns:

> That failure [to reduce effort to 1982 levels] has caused further depletion of stocks, and more importantly a critical decline in the abundance of mature sharks to numbers which will inevitably lead to recruitment failure.

Reichelt and Tilzey (1991) stress that the biomass estimates are preliminary results only and the variation could be a factor of two (-50% to +100%), that is, the biomass could be as low as 4 500 or as high as 18 000 tonnes. Nevertheless, the authors conclude that at the current annual catch of around 3000 tonnes the fishery is headed for collapse.

## Management

### *Jurisdictional problems*

The Fisheries Amendment Act 1980 made provision for a South Eastern Fisheries Joint Authority consisting of the Commonwealth Minister and appropriate Ministers from New South Wales, Victoria, Tasmania and South Australia. To date, such a joint authority has not been established and jurisdiction of the fishery has remained unchanged. OCS arrangements have not been instituted. It is, therefore, a 'status-quo' fishery.

The States manage the fishery in State territorial waters (3 nautical miles) while the fishery beyond that is managed by the Commonwealth (200 nautical miles).

Early regulatory efforts by the Commonwealth to reduce fishing effort through the issue of endorsements to those fishermen dependent on shark fishing by gillnetting was, to some extent, negated by the lack of complementary legislation by the States. The States did not alter the access rules in their shark fishery to complement those of the Commonwealth. Recent legislation by

Victorian and Tasmanian governments prevent fishermen who have sold their Commonwealth entitlements from continuing to fish in State waters. However, a limited number of fishermen in South Australia holding Marine Scale licences are able to target shark in State waters with hook or mesh net, irrespective of Commonwealth licence or endorsements previously held.

Although most shark is caught in Commonwealth managed waters, coordination with the States in communicating landings to AFS is necessary to make Commonwealth shark regulations enforceable at fishing ports. Since shore-based surveillance is less costly, it is preferable to minimise expensive sea surveillance operations (Commonwealth 1990). The States have tended to initiate complementary legislation to limit fishing effort after the Commonwealth has coerced them to do so.

*Historical account of legislation controlling shark fishing*

Throughout the history of shark management various laws have been introduced for various reasons. Since 1954 inshore areas around Tasmania have been closed to protect pupping areas. In Victoria, during the period 1953 to 1967 the fishing season was closed during October or November, the months prior to pupping. During the period 1972 to 1985 a legal maximum length (104 cm) was imposed on the sale of school shark marketed in Victoria, due to high levels of mercury concentrations found in older shark. Since the 1950s legal minimum lengths have been enforced.

Since 1975 a legal minimum gill net mesh size of 6 inches (15 centimetres) was imposed in Bass Strait. While this size limit applies across the whole fishery, fishermen off South Australia use 7-inch mesh by choice. This is due to size differences of shark found in each sector. The importance of mesh sizes was reflected in the views of the Southern Shark Fishery Task Force (SSFTF 1987, p. 25) that reported:

> Should the legal minimum mesh size be increased from 6" to 7" [in Victoria] the immediate effect would be a substantial reduction in gummy shark catches from Bass Strait, for at least two years.

The Commonwealth has become more extensively involved in the fishery, as indicated by the following chronology, which is based on information supplied by DPIE.

*Before 1984;* any vessel with a Commonwealth Fishing Boat Licence could take shark from Commonwealth waters.

*July 1984;* the Southern Shark Fishery Task Force was established. This was as a result of scientific reports on the status of gummy shark which indicated that further controls were warranted to protect the species.

The Task Force comprised representatives of Commonwealth and State Governments, industry and scientists. Through consultations with industry members, the Task Force assessed the need for rationalisation in the fishery and identified options available to the industry.

*25 September 1984;* the Task Force recommended immediate implementation of controls on fishing effort. The then Minister of DPIE, Mr Kerin, warned that additional investment in the fishery at that stage, would not be appropriate.

*14 December 1984;* the Task Force issued the following warning (DPIE press release 14 December 1984):

> the Task Force views with concern recent reports of rapid increase in investment and activity in the fishery...[consequently] the Task Force considered that 25 September [1984] should be the qualifying date for determining the eligibility in the event of such restrictions being incorporated into the management plan.

*29 November 1985;* 'interim' arrangements were announced to limit entry in the Southern Shark gillnet fishery: controls would apply from February 1986, for six months. Subsequently, 232 interim endorsements for Commonwealth Fishing Boat Licences were issued which permitted the vessel to take shark by gill netting.

*2 April 1986;* the Minister again warned longlining and gillnet fishermen against increasing investments in the Southern Shark fishery. Interim endorsements were made transferable, although only one endorsement could be attached to each Commonwealth licence. A limit was also placed on the number of boats which could operate in the fishery.

*22 July 1986;* the then Director of AFS, Dr Bain, announced that endorsements would no longer be transferable, because fishermen continued to invest in the shark fishery. Subject to a review by the AFS and the State fisheries authorities, the interim arrangements would continue to apply until a longer-term management plan could be finalised.

*August 1987;* after undertaking substantial industry consultation, the Task Force reported to the Australian Fisheries Council on the future management arrangements. The Task Force accepted biological evidence that stocks were over-exploited and that fishing effort should be reduced to the estimated 1982 level.

*April 1988;* a 'long term' Management Plan came into effect. Under the Management Plan the number of gillnets which a licensee could use was limited by a category A6 (six net units[1]) and category B (five or less net units) endorsements, while longlining remained without restrictions. The endorsement granted to each vessel was dependent on historical catch prior to 25 September 1984. In retrospect, it is evident that the individual net allocations should have been less.

The Management Plan restricted the transfer of all endorsements to immediate family members only, except for the period from 1 April 1988 to 30 May 1990 during which a net amalgamation program for category A fishermen operated.

The Management Plan allowed an A6 fisherman (6 units) to purchase the licence package of another A6 fisherman and amalgamate the two resulting in an A10 fisherman (10 units). This was intended to reduce effort in the fishery through removing an operator and the forfeiture of 2 units. On average an amalgamating fisherman paid about $100,000 to buy out another A6 fisherman and upgrade from an A6 to A10 endorsement. In theory, this amount should reflect the net present value of the expected increased profitability resulting from amalgamation.

As this program was only open to A6 fishermen many B fishermen who were not actively participating in the fishery held on to endorsements hoping to realise a profit if full transferability of entitlement was ever allowed.

The cost of buying out other fishermen placed a significant financial burden on those who amalgamated. It provided an incentive for amalgamated fishermen to work harder and catch more fish to pay for the licence which they had purchased. This resulted in further deterioration of the shark stocks.

*April 1991;* 22 operators had their units suspended and their licence endorsements revoked for non-payment of levy at this time, and consequently the vessels could not operate in the fishery. By 1 July 1991 all suspended entitlements had either been renewed, by payment of outstanding levy, or had been cancelled for failure to pay. From March 1991 to August 1991, 23 operators holding 114 units had their units cancelled for failing to pay the levy. This was due to a number of factors, which included declining harvest forecasts and the reduction of the period of 'grace' for renewal of entitlements from 12 to 2 months (Table G.12).

[1] A net unit is 600m in length and depth of 20 meshes, but can be up to a maximum depth of 40 meshes with the length reduced to maintain the overall area of the net. The endorsements are referred to as A6, B5, B4, B3, and B2 with the numbers refering to the number of nets permitted to be used.

Table G.12: **Commonwealth Boat Licence with gillnet endorsement numbers and net units in the SSF**

| *Year* | *Endorsements* | *Net units*[a] |
|---|---|---|
| May, 1988 | 232 | 1 189 |
| May, 1989 | 191 | 1 074 |
| January, 1990 | 155 | 965 |
| April, 1991 | 136c | 862[b] |
| July, 1991 | 131d | na |

Note: Active units (those in use) only are reported in table.

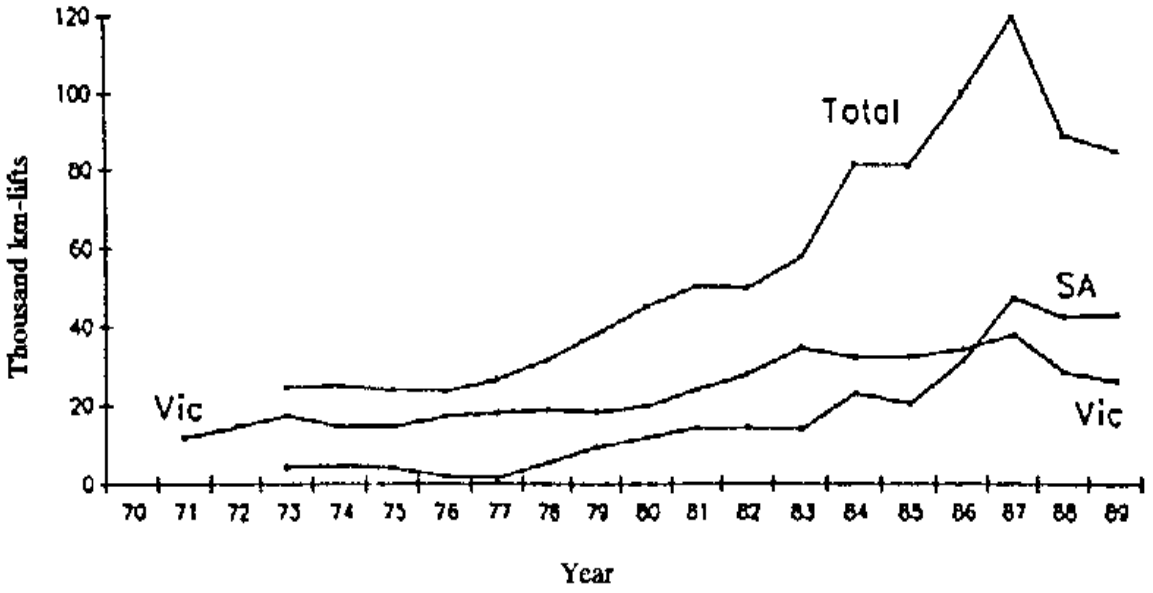
a) Previous to interim arrangements of April 1991, one net unit represents one net, after April 1991, a 10 unit endorsement represents seven nets, a 6 unit endorsement represents four nets, 4 and 5 unit endorsement represents three nets, while 2 and 3 unit endorsements represents two and three nets respectively. b) Representing 577 nets. c) Includes 22 suspended endorsements. d) Active units only, all suspended units reinstated.

Source: AFS. (DN: Personal communication Trysh Rajchert 15/7/91)

*New Directions* (Commonwealth of Australia 1989) acknowledges that input controls have failed to reduce fishing effort in the fishery, while imposing significant inefficiencies. These regulations have meant that fishermen substituted new inputs, including more advanced technologies, for the restricted input. In the case of the Southern Shark fishery, fishermen have increased their effort by fishing for a longer time, and the introduction of the GPS navigation system and more cooperation between fishermen in searching for shark have also contributed to greater effort.

The limited success in stemming the decline in the fishery could be attributed to the use of input controls, however, the uncertainty created in the fishery as a result of the lengthy process of formulating the Management Plan did not help matters. Yet, it is difficult to say precisely whether the increase of fishing effort observed during the deliberations of the Task Force (refer Figure G.6), was a result of fishermen 'staking a claim' or a result of declining catch rates in the fishery.

Figure G.6: **Fishing effort (equivalent gillnet[a]) by State for 1970 to 1989**




a) Includes fishing effort by the hook fishery which is converted to its equivalent in terms of gillnet effort.

Source: Walker and Gason 1990, Summary of Shark Catch and Effort Data for Victoria, Tasmania and South Australia during 1979-89, Background Document presented to the Sixth Southern Shark Assesment Workshop, 19-21 November, Queenscliff, p.7.

*Financial arrangements*

In 1987/88, AFS recovered 60 percent of certain management costs, this increased to 75 percent in 1988/89 and 90 percent thereafter. Costs are recovered by a levy applied to each net. A significant increase in AFS costs occurred in 1989/90 owing to the calculation of on-costs being changed from a flat 84 percent of salaries to actual costs. Total receipts increased in 1990 as a consequence of this change. However, in 1991 receipts fell as licensing fees (ie boat replacement and transfer fees, and licence renewal) were taken out and charged to fishermen on a fee for service basis. This has resulted in lower levy charges for 1990/91.

Table G.13 presents the AFS budget for the fishery, for the period 1988 to 1991. The management levy charge applied per unit is calculated by dividing the estimated management levy by the estimated number of units that will pay the levy. The levy charge is then rounded to the nearest $10. Because the levy is based on estimates, of both cost and number of units, it is acquitted at the end of the financial year. This results in a deficit or surplus carry-over into the following financial year. A period of grace, prior to the cancellation of units, where units are suspended and licence endorsements revoked, of 12 months was in force prior to April 1991, the period has now been reduced to two months on the request of industry.

Total AFS reimbursements to the States for surveillance for 1990-91 amounted to $280 702. Of this, South Australia received $103 000, Victoria $73 000 and Tasmania $104 404.

*Research and logbooks*

Scientific research is undertaken mainly by State fisheries agencies in Tasmania, South Australia and Victoria. The Southern Shark Assessment Group based at the Marine Sciences Laboratories (MSL) in Victoria undertakes the collation and analysis of logbook data for the fishery. CSIRO Division of Fisheries Dr John Stevens is a population dynamics expert also undertakes some shark research. The Southern Shark Research Group (SSRG) is an umbrella organisation which brings together research agencies undertaking shark research and provides scientific advice to Governments and the southern shark fishery MAC (SSFMAC).

Research into the southern shark fishery has led to the development of SHARKSIM, a computer model of the fishery, incorporating catch data since 1927, and biological information of school and gummy shark. It also takes into account available information on fishing gear selectivity. The model was developed by Software Insight Pty Ltd for the South Australian Department of Fisheries (SADF) under the coordination of SADF in conjunction with the MSL and supported by FIRDC and FDTA grants. SHARKSIM has been used to estimate sustainable yields and biomass estimates for the fishery (refer to section 'Status of the fishery'). While SHARKSIM is the best available model of the fishery, it has limitations. Reichelt and Tilzey (1991, p.1) note:

> SHARKSIM is a useful tool for predicting the effects of changes in catch levels, recruitment, and so on, but does not allow a full assessment of uncertainty in such estimates.

Table G.13: **Southern Shark Fishery budget 1987-88 to 1990-91**

| *Year* | *1987-88* | *1988-89* | *1989-90* | *1990-91a* |
|---|---|---|---|---|
| *Administration and licensing:* | | | | |
| SADF | 3 201 | 4 801 | 11 000 | 0 |
| VDCE | 16 697 | 11 200 | 9 733 | 0 |
| TDSF | 18 390 | 17 455 | 10 000 | 0 |
| DPIE | 72 743 | 60 758 | 105 849 | 102 560 |
| Sub-total | 111 031 | 94 214 | 136 582 | 102 560 |
| *Surveillance and compliance:* | | | | |
| SADF | 62 325 | 111 926 | 87 000 | 105 800 |
| VDCE | 133 360 | 80 910 | 83 481 | 71 040 |
| Tasmanian police | 114 663 | 116 923 | 87 985 | 104 117 |
| Contingency item | 0 | 0 | 0 | 33 000 |
| DPIE | 23 024 | 32 456 | 37 921 | 23 962 |
| Sub-total | 333 372 | 342 215 | 296 387 | 337 919 |
| *Logbooks and research:* | | | | |
| VDCE MSL database | 15 000 | 39 600 | 48 000 | 50 640 |
| TDSF | 3 866 | 0 | 0 | 10 067 |
| Central Aging Authority | 0 | 0 | 0 | 20 000 |
| DPIE | 27 891 | 17 767 | 45 310 | 55 271 |
| Sub-total | 46 757 | 57 367 | 93 310 | 135 978 |
| Total costs | 491 160 | 493 796 | 526 279 | 576 457 |
| Less Licence fees | 11 450 | 11 450 | 11 450 | 0 |
| Levy base | 479 710 | 482 346 | 514 829 | 576 457 |
| 60 % of levy base | 287 826 | - | - | - |
| 75 % of levy base | - | 361 760 | - | - |
| 90 % of levy base | - | - | 463 346 | 518 811 |
| *Add 100 % recoverable costs:* | | | | |
| SSFMAC costs | 0 | 13 268 | 1 559 | 5 000 |
| Carryover from previous year | 0 | 14 482 | 10 118 | -49 167 |
| **Management Levy Base** | **287 826** | **389 510** | **475 023** | **474 644** |
| Levy charge applied per net ($)b | 250 | 350 | 570 | 500 |
| Revenue collected | 273 344 | 379 392 | 524 190 | 467,108 |
| Carry forward surplus/(deficit) | (14 482) | (10 118) | 49 167 | (7 536) |

Notes: See 'Abbreviations' section for acronyms.

a) Estimated.

b) Based on estimates.

Source: AFS.

The South Australian Shark Fishermen's Association (SASFA), believes that shark stocks are higher than SHARKSIM estimates indicate. The SASFA submitted that the database on which the computer model is based does not include data from west of Kangaroo Island and that catches from this area represent 80 per cent of the total South Australian catch. Reichelt (personal communication 1991) concedes that the model does not incorporate the fishing of new grounds towards the west, but indicated that preliminary evidence of declining shark size and catch per unit effort in the western area indicates that the addition of data from this area will not greatly alter the SHARKSIM biomass estimates. However, he claimed that the addition of these data is a high research priority, which will improve the model's predictive capability.

Some shark fishermen provided anecdotal evidence from their own catch history to support their case that SHARKSIM biomass estimates are too low. However, Reichelt and Tilzey (1991, p. 3) warn that:

> Short-term changes in catch rates are misleading. In this fishery only the long term catch data set should be used to assess fishery trends and then used with caution. For example, any schooling behaviour (or other form of aggregation) by the sharks, or any increase in efficiency by the fishermen in terms of locating sharks, will result in catch rates being an optimistic indicator of stock abundance.

*Financial performance*

ABARE undertook a financial survey of the southern shark fishery for the 1988-89 financial year (Campbell et al 1991), and the findings are presented in Table G.14. ABARE will use the results of the survey to assess the possible economic impact of various management proposals. The return to full equity is calculated on the basis of total receipts from the diversified fishery. A majority of the fishermen with A6 and B endorsements are not fully dependent on the shark catch. These fishermen made a return to full equity which was far less than the inflation rate. One implication may be that the below average returns of these fishermen may be due to the poor performance of the other fisheries on which they depend.

Campbell et al (1991, p.5) conclude that:

> ...fishermen in 1988-89, on average, made a return (rate of return to full equity which excludes interest payments made in servicing debt) which was less than the inflation rate, ... they did not make a return on capital and that any potential economic rent that may be generated by the fishery was being dissipated because of excess fishing effort.

However, one group of fishermen, holders of A10 licence endorsements, were making a return to full equity greater than the inflation rate.

Table G.14: **Financial performance of shark operators, by entitlement held, 1988-89**

| | *Unit* | *A10s* | *A6s* | *Bs* | *Other* | *Total* |
|---|---|---|---|---|---|---|
| Catch | tonnes | 54 966<br>(13) | 26 185<br>(6) | 13 981<br>(15) | 5172<br>(25) | 10 117<br>(11) |
| Average return[a] | $ | 243 978<br>(9) | 172 816<br>(9) | 114 740<br>(7) | 67 501<br>(15) | 88 892<br>(9) |
| Cash operating surplus[b] | $ | 29 531<br>(35) | 10 710<br>(79) | 1327<br>(296) | 3036<br>(77) | 4716<br>(42) |
| Return to capital[c] | $ | 12 514<br>(87) | -3303<br>(278) | -13 879<br>(32) | -3339<br>(77) | -3713<br>(59) |
| Return to full equity[d] | $ | 41 419<br>(24) | 5743<br>(147) | -3639<br>(106) | 1125<br>(206) | 3034<br>(65) |
| Rate of return to full equity[e] | % | 18.3<br>(25) | 3.2<br>(151) | -2.3<br>(104) | 1.3<br>(208) | 2.8<br>(67) |

a) Net of sales commission and freight charges. b) Defined as total returns less total cash costs. c) Defined as cash operating surplus less depreciation. It represents the monetary return to the capital employed in the fishing enterprise together with a return to the owner-operator. As such, it provides a measure of short term cash availability for the business unit. Capital investment excludes value of endorsements bought during the amalgamation program of May 1988 to May 1990. d) Defined as the return to capital and management after adding back all interest payments incurred by the business unit (excludes interest payments made for capital borrowed for net amalgamation). It represents the return which would have been earned by the business unit had the boat been fully owned by the operator. It is therefore a measure of the total return to capital employed in the business and allows the comparison of such returns across all boats in the fishery. e) Obtained by dividing the full equity return by average total capital employed, as given by the capital value of the boat, and multiplying by 100.

Note: Figures in parenthesis are relative standard errors (RSEs) expressed as percentages of the estimates - 95 per cent of operators should have financial measures which lie within plus or minus two RSEs of the estimates shown.

Source: Campbell et al (1991).

## Recent developments

The current Southern Shark Fishery Structural Adjustment Task Force was set up in September 1990. Since 22 February 1991 membership consisted of one representative from the industry, BRR, AFS, ABARE and individual State fisheries agencies. The task force has the brief to develop options for structural adjustment, and present their recommendations to the SSFMAC.

In March 1991, the then Minister for Primary Industries and Energy, John Kerin, announced that the total annual catch of school and gummy shark needs to drop from over 3500 tonnes to between 500 and 800 tonnes. The interim arrangements announced came into force on 15 April and lapsed on 15 October 1991. They were designed to reduce the number of nets operating in the fishery by approximately 30 percent according to the following formula: those holding ten nets were reduced to seven nets; those holding six nets were reduced to four nets; those holding four or five nets were reduced to three nets; and those holding two or three nets were not reduced.

Work on the introduction of limited entry in the hook fishery commenced in May 1991. However, entry into the hook sector currently remains unlimited (a CFBL being the only requirement) since agreement has not been reached with the States and industry regarding the appropriate catch levels for entry and by-catch levels for other fishermen.

## Summary

By July 1990, the management plan instituted in April 1988, resulted in the removal of about 40 per cent of the units allocated in the Commonwealth sector of the fishery to 965 nets and the number of boats to 155. The overall effect of the plan was to remove those boats that were less active. The nets removed accounted for only 20 per cent of the catch and effort reduction. Considering that the 1988 management plan aimed at a 30 per cent effort reduction, the results have not been adequate. Campbell et al (1991, p.11) note that:

> Based on the same total fishery and per boat catches as in 1988-89 the 2200 tonnes could be taken using 52 boats... This would involve a 90 per cent reduction in the number of boats. On the same basis, an annual catch of 500 tonnes could be taken using six boats.

Furthermore, during the three years since the implementation of the management plan, the state of the fishery has worsened, requiring an upgrading of the effort reduction target. It is clear that effort reduction had been too slow to keep up with the changing status of the fishery.

Although a large number of nets were removed from the Commonwealth fishery, many of the operators that left continued to fish in State waters. In effect, total fishing effort in State and Commonwealth waters decreased by less than the removal of nets from the Commonwealth fishery. Campbell et al (1991) indicate that B endorsed licence holders who surrendered their Commonwealth endorsements in 1988 averaged catches in 1989 that were only marginally lower than that of 1988. Although recent legislation by Victorian and Tasmanian governments prevents fishermen continuing to fish in State waters after giving up Commonwealth licences, this legislation is not retrospective, and therefore, cannot remove excess effort which shifted into the State fisheries from the Commonwealth fishery. Meanwhile, fishermen in the South Australian Marine Scale fishery are able to target shark, irrespective of Commonwealth licence or endorsements previously held. This illustrates the very real problem of politically-determined boundaries which have no relationship to ecological/ biological relationships.

Another reason for the lower than expected decline in fishing effort during the amalgamation period was changes in the structure of the fishery. Amalgamation resulted in a group consisting of more highly efficient operators with greater fishing capacity, while new financial commitments, as a result of the amalgamation program, provided an incentive to increase fishing effort.

In 1989, catch per unit effort was significantly higher than the 1987 level. The increase has been attributed to a number of factors, including removal of less efficient operators, increased fishing efficiency resulting from improved technology such as the GPS navigation system and increased cooperation between fishermen searching for shark (Campbell et al 1991). These factors have meant that shark numbers have continued to be in decline in State and Commonwealth waters.

However, the interim arrangements for net reductions have been more effective. These arrangements introduced in April 1991 have resulted in an immediate decrease by one third of the nets allowed to operate in the fishery. This and stricter arrangements for licence renewals have seen 23 endorsements lapse since March 1991.

# G.4 SOUTHERN BLUEFIN AND EAST COAST TUNAS

**Location**

*Southern Bluefin Tuna (SBT)*

The Australian fishery for southern bluefin tuna (SBT) is located in coastal areas to the west, south and south-east of the Australian land mass, as shown in Map G.4. The fish begin to spawn at 8-9 years of age, and are known to live in excess of 20 years. The fish spawn in waters to the north-west of Australia and south of Java, and move down the west coast of Australia, around the south coast, reaching the fishing grounds in eastern coastal areas by which time they are some five years old.

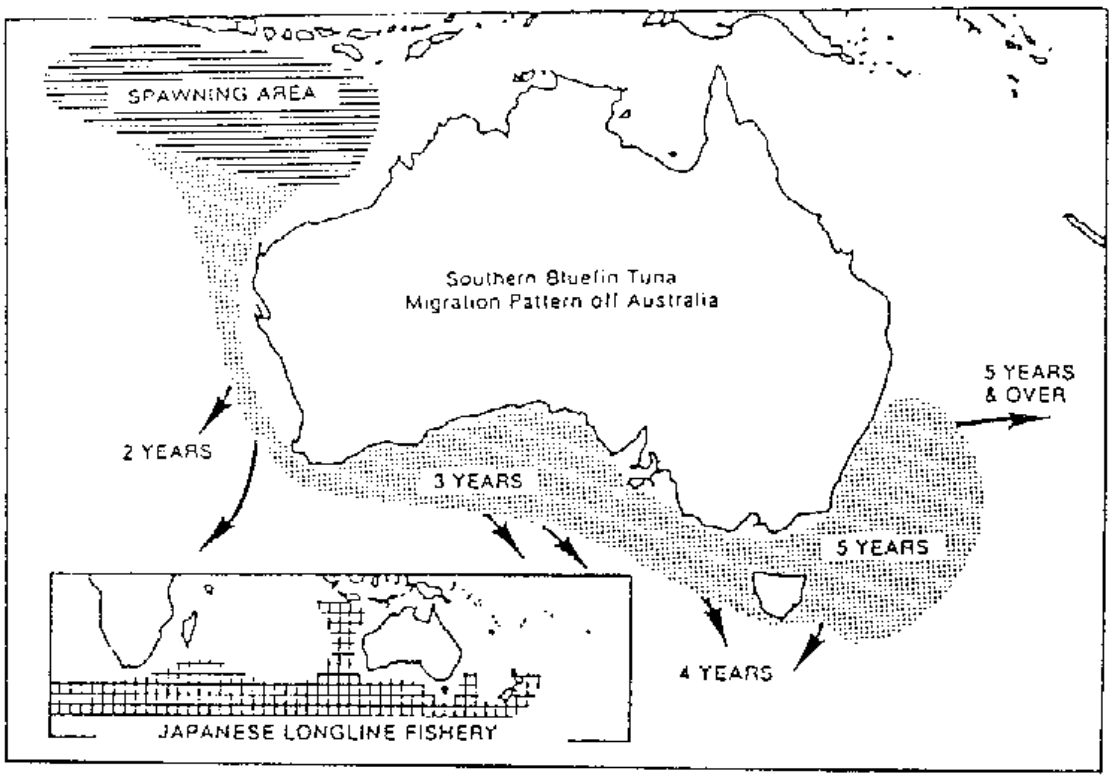
The main ports involved are, or have been, Albany in Western Australia, Port Lincoln in South Australia and Eden in New South Wales.

SBT are also caught outside Australian waters by fleets from Japan, Korea, Indonesia, Taiwan and New Zealand. However, only Australia, Japan and New Zealand are parties to the agreement on management of the SBT fishery.

*East Coast Tuna*

As shown in map G.5, the East Coast Tuna fishery extends down the east coast from the tip of Cape York to the southernmost waters of the NSW coast. In the northern area yellowfin and bigeye tuna, and albacore are the species caught. In the southern area all these plus southern bluefin tuna (SBT) are caught. Currently the tuna longline and purse seine fisheries are under interim management arrangements.

Map G.4: **The Southern Bluefin Tuna (SBT) fishery**



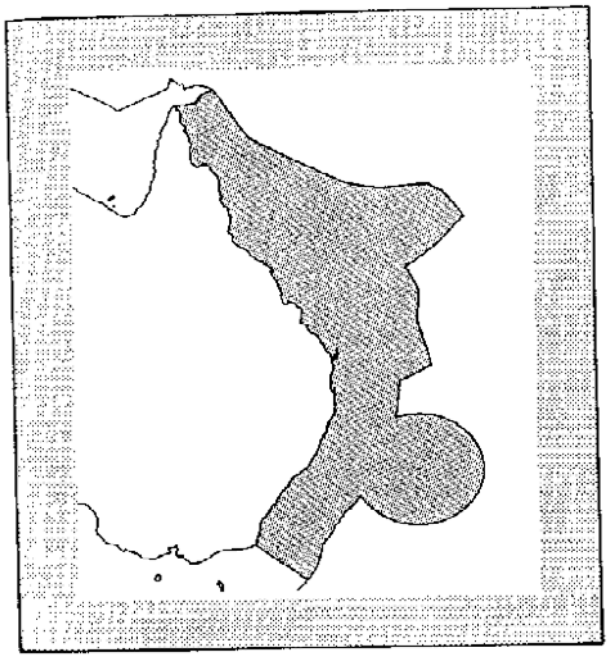

Source: AFS.

## Volume and value of catch

*Southern bluefin tuna (SBT)*

The total allowable catch (TAC) has been decreased over the years. In 1961 the unrestricted catch by Australia, Japan and New Zealand peaked at over 81 000 tonnes. Australia caught 3678 tonnes and Japan 77 491 tonnes. The total catch by these three countries has declined considerably, to under 50 000 tonnes per year after 1972, and less than 40 000 tonnes from 1984 when quota arrangements were introduced.

Map G.5: **The East Coast Tuna fishery**



Source: AFS 1990, Background Fisheries Statistics, Issue Number 4, Fisheries Paper 90/3, May, Canberra.

An interim catch limit of 21 000 tonnes was imposed by Australia for domestic operations in the AFZ in 1983. By 1989-90 Japan, Australia and New Zealand had agreed upon a global total allowable catch (TAC) of 11 750 tonnes. Of this, 5265 tonnes was allocated to Australian fishermen, 6065 tonnes to Japanese and 420 tonnes to New Zealand fishermen. These levels have been retained for 1990-91, but have been effectively reduced to 10 750 tonnes by Japan's agreement to pay Australian fishermen not to catch 1000 tonnes of the Australian quota. According to AFS, of this 1000 tonnes, 700 tonnes was 'frozen' and 300 tonnes caught under the 'real time monitoring' research program financed by Japan. Under the 1991-92 agreement, the global quota and entitlements remain unchanged, while no quota has been 'frozen'. Under the new agreement, 800 tonnes of Australian quota has been set aside for notional use in a research programme to be conducted by Japanese vessels. The Japanese pay $2000 per tonne of SBT under the programme, of which $1750 per tonne is paid to fishermen for use of their quota and $250 per tonne is paid to AFS to cover costs of running the programme, which includes placing observers on Japanese vessels.

There is still no sign of the return of surface schools of young SBT to the NSW coast. A Bureau of Rural Resources report (BRR 1990, p. 1) stated that:

> If the current low catches continue to decline there appears to be little prospect of any recovery in the SBT fishery in the short or long term, and the species could be fished to extinction.

But, it seems that the present depletion of stocks could have been avoided if managers heeded the advice of CSIRO in 1985. As Peter Young, the Director of the CSIRO Division of Fisheries stated:

> ...about 6 years ago ... CSIRO recommended a global quota for southern bluefin tuna. After the trilateral agreements the quota for southern bluefin tuna was somewhat in excess of several thousand tonnes of that recommended by CSIRO ... I understand the following year a similar occurence happened. The reasons given by the managers at the time were that elements other than strict biological elements were involved in management.

In 1988-89 the value of the Australian catch was $40 million landed at wharf (AFS 1990). In 1989-90 the value decreased to $25 million, and would not be expected increase significantly in 1990-91 (AFS 1991).

Japanese involvement in the industry, and the payments made for access, are discussed further in the section on 'Foreign Fishing Interests'. The Japanese fishery extends from New Zealand west to South Africa.

*East coast tuna*

The gross value of production for 1988-1989, 1989-90, and 1990-91, was $4.7 million, $3.5 million, and $4.6 million respectively.

## Structure and catching methods of the Australian fishery

In 1988-89 a total of 40 boats were involved in the SBT fishery, using the pole and line, purse seine and longline methods. The number of boats now full time in the fishery is 10.

The use of the purse seine method has been greatly reduced, due to the inability of the purse-seine method to result in a high quality catch.

The Port Macdonnell Professional Fishermen's Association proposed the banning of purse-seine operations and the development of longlining at an IAC hearing in 1984, as purse-seine methods could not produce sashimi grade fish.

In the East Coast Tuna fishery there are some 169 commercial boats endorsed to longline. There are 11 purse seine vessels endorsed for the east coast which target skipjack tuna.

## Markets and prices

Markets for the catch include the Japanese market for sashimi and lower grades of fish, and the domestic Australian canning industry and fresh fish market. Sashimi tuna should weigh at least 15 kilograms each and be in perfect fresh and undamaged condition. High prices can be obtained on the Japanese market for fish which are not only large but also have a high fat content and are in perfect condition. Perfect specimens in unblemished condition can attract exceptionally high prices. In Japan SBT landed by Japanese vessels retails as a 'high value' fish.

The average price of SBT in Japan was some $48 per kilogram in 1989, with other tuna species getting only a twentieth to a fifth of this price (ABARE 1990a). Price data from the Ulladulla co-operative indicate that the average price received for SBT in late June and July in 1990-91 was approximately $60 per kilogram. However, there was a great variation between the lowest price received for an individual consignment, just under $2 per kilogram, and the highest price of almost $200 per kilogram. Around one half of consignments received a price of around $20 to $40 per kilogram.

Kennedy and Pasternak (1991) state that SBT harvested by the Australian industry and exported to Japan is sold on the low grade sashimi market and obtains only some 10 per cent of the price for Japanese caught high seas tuna. However, this price differential relates mainly to frozen tuna from South Australia. Consignments of air freighted fish of exceptional quality from New South Wales and Tasmania are able to compete and obtain the high grade sashimi price.

Japanese consumers have a preference for fresh fish, and imports of live and fresh seafood into Japan have increased in response to this (ABARE 1991a). Frozen SBT tends to obtain a lower price compared to fresh or chilled SBT, but other quality characteristics are also important in determining price. SBT and other tuna caught by the Japanese fleet in the AFZ, or returned to Japan by mother vessels in joint venture arrangements, is frozen.

A participant, Mrs Anna Stehr of the Stehr Group, stated that:

> By long lining and being very, very careful with your tuna and treating them like eggs, and then air freighting them to the Tokyo markets or maybe the markets in Sydney, you are trying to get maximum income from the reduced quota.

A representative of the Tuna Boat Owners Association (TBOA), Mr Brian Jeffries, said that cost increases could not be passed on in the tuna export market because of the small number of buyers, and because the buyers themselves operate mainly on behalf of the Japanese tuna fishing industry:

> ...in an export-oriented industry where prices fluctuate day to day, month to month, year to year, there is no way that you can automatically or otherwise in tuna's case, pass on those cost increases, particularly where you are dealing with one market product where the market itself, the central market, which decides the prices of the other markets, is actually duopolised by a couple of government licensed wholesalers who are largely operators of the Japanese tuna industry, who are our direct competitors.

Most of the tuna harvested in Australia, especially smaller and poorer quality fish, is used for canning.

## Management

*Jurisdiction*

The Commonwealth Government has jurisdiction over the SBT fishery. Management advice for SBT is provided by the SBT Management Advisory Committee (SBTMAC). The East Coast Tuna Management Advisory Committee (ECTUNAMAC) advises on East Coast Tuna issues. Jurisdiction over the East Coast Tuna fishery is primarily a Commonwealth responsibility although OCS arrangements with New South Wales regarding tuna are yet to be finalised.

*Management methods*

Global and Australian quota for SBT is determined in annual consultation between Australia, New Zealand and Japan. Attempts are being made to develop a co-ordinated approach with these and other countries catching SBT, so that management of the stock is improved. The domestic SBT fishery is managed under the SBT Fishery Management Plan, with consultation with the SBTMAC. Joint venture and charter catching arrangements have been negotiated directly with Japanese and other interests by representatives of the Australian tuna industry, as part of Australia's move to longlining.

The east coast tuna longline and purse seine fisheries are currently managed under interim arrangements as a limited entry regime. Extension of the management arrangements to waters off eastern Victoria and Tasmania have been reviewed.

In the East Coast tuna fishery limited entry is the main management method. This fishery is one with a high level of participation by recreational fishermen. Entry limitations for yellowfin, bigeye, skipjack and other tunas were announced by the Minister for Primary Industries and Energy on 16 July 1991. Limitations were already in force for SBT under ITQ arrangements, as discussed below. The objective of the entry limitations is to prevent large, unsustainable increases in effort and to enable the controlled growth of the tuna fishery.

*Quota prices*

The price that quota is sold for may give an indication of the state of the fishery. It should be noted, however, that the market for quota units is not a perfectly competitive one, as there are not a large number of potential bidders, and the degree of certainty associated with the available scientific and economic information is low. As such, details about the going price for quota should be used tentatively to say anything about the biological and economic state of the fishery.

Initially, prices paid for quota units increased as harvest costs fell: the ITQ scheme was estimated to have reduced the average cost of catching a tonne of tuna by 25 per cent. However, as Dr Roger Rose of ABARE stated, some individuals have lost substantially because they borrowed money to buy quota which has not been worth as much as had been initially anticipated. This has been associated with the fall in the SBT biomass, and consequent high catching costs. It can be seen that the imperfections in the market for quota, combined with the over optimism of some fishermen, have caused equity problems in as much as the system promotes the transfer of quota yet fishermen have a poor understanding of its value.

SBT quota sells at different prices to domestic fishermen and to the Japanese. Quota sold for $800 to $1200 per tonne in 1984, rising to $3200 to $3500 per tonne by the beginning of the 1986-87 season (Franklin 1987, cited in the ABARE submission). The value of quota continued to rise: the one year lease value of quota leased to Japanese tuna fishermen in 1989 under a joint venture arrangement was nearly $2000 per tonne (ABARE 1990). ABARE submitted that this one year lease value was equivalent to a sale value of $6000, assuming a discount rate of 20 per cent and a time horizon of five years. The price the Japanese would be prepared to pay would include the equivalent of the access fee which would otherwise be payable to the Australian government.

The current lease value of SBT quota was reported by John Prokopice, Chairman of the Tasmanian Sashimi Tuna Fishermen's Association (TSTFA), to be $1100 a tonne, the price having decreased from the $1600 per tonne the fishermen had paid to lease quota from Western Australia in 1990. TSTFA reported that there were recent possibilities of leasing quota from the South Australian Tuna Boat Owners Association for $800 a tonne. Dr Gerry Geen of ABARE said that he understood that quota had been leased to the Japanese on an annual basis for $4000 a tonne, and that:

> ...certainly there is a market for quota but there are certain restrictions on how much of it the Australian Fisheries Service are prepared to see the industry lease to Japan.

AFS negotiates with the Japanese to determine the quantity that it is permitted to lease, pending agreement on price with the TBOA.

In 1986 the Japanese fishing industry provided funds to the Tuna Boat Owners Association of Australia for not catching part of its SBT quota. The amount agreed upon was 3000 tonnes per year (BRR 1990, p. 33). However, the third and final year of the agreement was cancelled.

Such arrangements have arisen because of the difficulties Japanese fishermen were experiencing in catching, within the AFZ, their full quota of SBT. This was due to their having to compete with Australian SBT fishermen with more favourable zone arrangements in the face of a decline in SBT stocks. It was profitable to pay some of the Australian fishermen not to fish, by leasing their quotas.

The Tuna Boat Owners Association (TBOA) commented:

> With the Japanese industry we have had over the years a range of agreements; they are formal agreements. They are government generated from the point of view the government has said to both industries that, 'We give you the options of cutting the catch somehow. Option 1 is that you cut the catch in the normal way, where we reduce the total global quota...
>
> ...Now, when we have been given those options the Australian and Japanese industries have discussed the issue and come up with various other options to reduce the catch. That is what is called a freeze, where the Australian or Japanese industry freeze part of their quota in return for some financial compensation from the other industry. We have, secondly, other agreements with the Japanese industry on the introduction of long-liners to Australia.
>
> With the Japanese government we have various agreements, mainly concentrating on the development of southern bluefin farming. A 2-year research project that we have introduced in January this year is in co-operation with the Japanese government. The agreements we have with Pacific countries are with governments. They are formal agreements, either annual or bi-annual, for access to those countries. So those arrangements are with the association and not the Australian government.

*Some unexpected consequences of the rationalisation*

A lack of collective action concerning the positioning of fleets can lead to a reduction in total fishery profitablity. This is because unilateral decision making can make it profitable for individual vessels to fish further east, so that unit harvest costs are reduced by fishing denser stocks. An operator may decide that the reduced costs more than outweigh the lower value of smaller fish, particular since most domestic vessels are not capable of targeting fish large enough for the sashimi market.

This problem was not anticipated, and there have been suggestions that a zoning of the quota would alleviate the problem. It must also be recognised that domestic operators were expected to change over to long-lining once ITQ's were introduced, however it appears that the capital equipment is not as easily transferrable as anticipated. This has accentuated the problem because the benefits from fishing to the east are reduced.

In particular, it has been observed that some of the domestic fleet is fishing off Western Australia when it was expected that they would all fish for higher value fish in the east.

In addition, a major incentive behind the Japanese decision to be involved in the joint venture to train Australian crews in long-lining techniques could be their desire to catch fish in the more westerly domestic zone, which they can now do (but only for that amount of catch included in the scheme)

*Financial arrangements*

The Commonwealth Government charges fees for access to the AFZ by foreign and joint venture vessels. These payments are partly to cover management costs, and partly a fee for access to the resource. They also include normal licence fees. Details of the access fees are given in the 'Foreign Fishing' section of this Appendix.

Industry pays 90 per cent of the costs for administration and surveillance for the domestic tuna fisheries. AFS recoverable expenditures for tuna fisheries management in 1990-91 were a total expenditure of $479 573 on SBT, $372 181 for East Coast Tuna, giving a total overall recoverable expenditure for tuna fisheries of $851 754. This does not include amounts for access by foreign fishermen.

The expenditure on SBT in 1990-91 comprised $130 678 for administration, $292 895 for surveillance and compliance, and $56 000 for research. An additional $980 282 from the Prime Minister's environmental research grants was spent on research. The equivalent figures for East Coast Tuna were $143 889 for administration, $89 650 for surveillance and compliance, and $180 000 for research. An additional $228 000 was received under bilateral access arrangements for east coast tuna and billfish research. Total attributable AFS expenditure for tuna in 1989-90, was $449 000 for SBT and $354 000 for East Coast Tuna.

The allocation for administration of the tuna fisheries in the budget proposed for AFMA for 1991-92 is $327 000.

*Surveillance*

AFS expenditure on surveillance for all domestic tuna fisheries in 1990-91 amounted to $382 994, which amounted to 80 per cent of all expenditure on these fisheries. SBT accounts for some three-quarters of all tuna surveillance expenditure.

Surveillance costs reimbursed to the States for SBT amounted to $278 679 in 1990-91, of which $170 291 went to South Australia and $70 000 to Western Australia. This does not include AFS internal costs, which amounted to $14 216 for SBT surveillance and monitoring.

The placing of observers on foreign vessels to ensure compliance with the access requirements is part of the surveillance program. Around a fifth of Japanese tuna fishing in the AFZ is undertaken with an observer on board. The cost of surveillance of foreign boats is fully recovered along with other management costs.

In 1990 two Japanese longline tuna boats were found to have been under-reporting their catch, the first vessel by a half and the second up to 30 per cent. The master of the first vessel was banned from fishing in Australian waters for two years and ordered to pay costs of $4635. The second boat and its catch and equipment were forfeited to the Commonwealth and its owner and skipper each fined $10 000 (Australian Fisheries 1990a). In the first case the catch was valued at $3.5 million, in the second $6.3 million. AFS states that procedures which make the detection of under-reporting easier, and hence facilitate its prevention are being introduced.

*Research*

In 1989-90 the actual expenditure undertaken by AFS on tuna research was $242 000, and the budgeted amount for 1990-91 was $180 000. The allocation for tuna research in the budget proposed for AFMA for 1991-92 is $320 000.

*Management history*

In 1971 voluntary seasonal closures were adopted by the Japanese longline fleet in areas off southern NSW, South Australia and South Africa. In 1975 a freeze on entry to the Australian domestic purse seine fishery was introduced and purse seining was banned in the Western Australian fishery.

In 1976 the entry of new pole vessels was prohibited in waters covered by the then South Eastern Fisheries Committee, membership of which comprised South Australia, Victoria, Tasmania and New South Wales. A limited entry regime was introduced to the SBT fishery in 1976. It had become apparent (Senate Committee 1982, p. 33):

> that the resource was at risk from overfishing and that control measures were required to protect the biological and economic stability of the fishery.

In 1981 the limited entry regime was abandoned. The stated reason as given by the then Commonwealth Minister for Primary Industry (House of Representatives 1981, p. 1353) was that 'the freeze has been ineffective in achieving its objective of stabilising investment in the fishery'. This conclusion was based on an economic study undertaken by the Commonwealth Department of Primary Industry. It has been argued (House of Representatives 1981, p. 1354) that the study did not reach any firm conclusions to justify the abandonment of limited entry, and evidence was presented to the Senate Committee (1982, p. 35) that entry of more boats into the fishery must result in decreased profitability for the fishery.

Management of the SBT fishery has been complicated and frustrated by the fact that vessels from three states (New South Wales, South Australia and Western Australia) have been involved. The interests of the different groups of fishermen and the different governments do not coincide (Senate Committee 1982, p. 35). As Tisdell (1985) points out there is an interdependence between the interests of fishermen in the three states:

> Catches early in the migratory path tend to lower stock later along the path. Thus catches in W.A. tend to lower the stock available in S.A. Catches in S.A. tend to lower the stock available in N.S.W. and eventually to Japan. In these circumstances co-operative management appears to be rational.

The Senate Committee (1982, p. 36), in presenting an overview of the management of the fishery, found that there had been a failure to restrain effort and it was not convinced the fishery should be left unmanaged. The Senate Committee concluded that effort control, including a vessel replacement policy, was required.

As a consequence of the Senate Committee's findings a management plan was put in place for the fishery. In 1983 an interim management program introduced a catch limit of 21ÿ000 tonnes (BRR 1990). The fishery was investigated by the Commonwealth Department of Primary Industry and the Industries Assistance Commission. In 1984 an IAC report (IAC 1984) recommended the introduction of quota arrangements for 1984-85 consisting of an Australian quota of 14 000 tonnes and an agreed Japanese catch of about 16 000 tonnes. It was anticipated that these quotas would ensure the commercial survival of the fishery, and that they would require a significant reduction in boat numbers. The quotas were allocated to individual Australian fishermen as ITQs on the basis of catch history, with the total Australian catch being limited to 14 500 tonnes.

The total catch was restricted for biological reasons. As Bain (1985) stated, the fishery had `clearly been biologically overfished'. Bain, at that time Director of the Australian Fisheries Service (AFS) and therefore the most senior Commonwealth fisheries administrator, also stated that `priority had to be given to reduce resource depletion and enabling the development of the sashimi component of the catching and marketing arrangements'. With regard to the new management plan, he observed that:

> It has been very difficult to allocate quotas in an equitable and acceptable manner and the Government is facing protracted and costly legal and political arguments on this issue. This problem has been compounded by the need to substantially reduce the catch in the same year as ITQs were introduced...Rapid transfer of quota has taken place. The larger, more specialised operators have tended to purchase quota and to endeavour to increase

> the component of their catch which is suitable for the relatively higher price sashimi market. Generally the adjustment is proceeding in the desirable direction from both biological and economic points of view. (But) the speed with which the adjustment has taken place has caused considerable concern in Governments and industry and has resulted in significant adjustment problems, particularly in Western Australia. The canneries in Western Australia appear to face a very uncertain future and this has regional employment implications with the economic and biological criteria for the good management of the fishery. Scientific monitoring, administrative (sic) and enforcement are requiring a lot of effort but, hopefully this will be reduced when the initial 'teething' problems are over. There may be a need to impose additional regulations to reduce the take of small fish...Overall, the...industry appears to be adjusting in the manner one would forecast from the economic models. In the long term the scheme should be easier for administrators and politicians to manage than any of the alternatives...The experience...has emphasized the possible impact...on the structure of a fishery and this is becoming a major concern to industry and governments. It is clear that management measures may result in the aggregation of much of the fishing industry into a few large groups which operate big, efficient vessels. Large numbers of the smaller fishermen may have to sell out and closures of co-operatives and canneries may occur. The implications for coastal towns and regional employment can be severe.

One effect of the introduction of quotas was to shift the focus of the industry to South Australia. TBOA submitted that:

> The introduction of ITQs led to rapid rationalisation, with the SA industry, to maintain viability, buying up most of the quota from WA and NSW. This buy-out occurred largely in late 1984 and in 1985 and led to around 93 per cent of the quota being owned in SA. The value of the quota purchased was over $10 million....

A major problem facing management of SBT has been the international nature of the resource, and the rivalry between Australian and Japanese interests. Such difficulties in management were perhaps inevitable, considering the migratory nature of the species through its life cycle through international and national waters, and the need to obtain agreement on an international and a State basis.

Trends in the catch in later years indicate that the measures taken in the seventies and first half of the eighties to prevent the reduction in the stock of SBT failed to do so.

In 1985 Japan agreed to limit its 1986-87 global SBT catch to 23 150 tonnes, but in practice was not able to reach this figure.

Following a 1988 scientific report which recommended reductions in catch in all sectors of the fishery, the quotas for Australia, Japan and New Zealand were set at 6250, 8800 and 450 tonnes respectively (BRR 1990).

The catch quotas set in 1984 and 1985 were set too high, in the light of the continuing falls in catch and increases in fishing effort required to obtain these. While the quotas were further reduced in 1988 as indicated above, Caton, McLoughlin and Williams (BRR 1990, p. 34) state that 'The 7th trilateral scientific report in 1988 pointed out that the only safe catch that could be recommended would be zero'. In the Prime Minister's July 1989 Statement on the Environment there was a reference to an intention to press for a global moratorium on the taking of SBT. Such a moratorium would require the agreement of Japan, New Zealand and other countries involved in the fishery. Such an agreement has not been reached as yet.

As already indicated, checks on two Japanese tuna vessels in 1990 found evidence of significant under-reporting of catch. If under-reporting was more widespread, this would be a serious problem.

Another negative aspect associated with the rationalisation has been the adverse affect on the SET fishery, as the reduction in capital in the SBT fishery accentuated the overcapatilisation problem in the SET. As a direct consequence of the introduction of ITQs a number of vessels left the fishery, including 11 NSW boats which were subsequently granted SET endorsements. A further 3 South Australian based boats which were originally granted SBT quota were also granted an SET endorsement. They are no longer used to fish for SBT. It is therefore evident that a total of 14 boats entered the SET as a consequence of rationalisation in the SBT fishery. At the time the SET was under open access. This demonstrates that interdependencies between fisheries, both biological and capital related, should be taken into consideration when rationalising, or developing a management plan, for a fishery. Perhaps if rationalisation had taken place in the SBT and SET fisheries simultaneously then vessels may have exited the industry, and not just one fishery.

*Conflict with recreational fishing*

As suggested in the section on Recreational Fishing, there is conflict between the interests of commercial and recreational fishermen in the use of tuna resources. The East Coast tuna fishery has a high level of participation by recreational fishermen, estimated to account for some 25 per cent of the yellowfin tuna catch. Commercial fishermen have reported significant taking of SBT by charter vessels off Tasmania, and they have claimed that SBT, which would have had a high value on the sashimi market, was used as burley for recreational shark fishing. Mr John Prokopice of the TSTFA described the effect of recreational fishing for tuna off Tasmania:

> ...the commercial fishermen at the moment virtually have got to tie up their boats on weekends ... over the last two weekends, there would probably be 60 to 70 boats in one area that is 5 miles long.

**Recent developments**

Arrangements have been approved by the Minister for Primary Industries and Energy which allow Australian operators to charter large longline vessels to fish for SBT in Australian waters. The aim of the arrangements is to give the Australian industry a chance to use a method of taking larger fish which is more compatible with sustaining the resource. In 1991, 3 vessels were imported into Australia for the venture. Details of the joint ventures are given in the section on Foreign Fishing. The potential long term benefits involved have been stated to be very large, with a potential move from a $30 million per annum fishery to one that could be worth hundreds of millions per annum (DPIE 1990a).

**Assessment of management**

The major failure of SBT management to date has been its inability to contain fishing mortality at levels consistent with the sustainability of the resource. With regard to the recovery of the fishery, it will not be possible to ascertain whether the parent SBT stock (fish older than eight years of age) has begun to rebuild, or whether restraints have been inadequate, until the mid-1990s (Australian

Fisheries 1990c ). Late and inadequate action in earlier years has meant that sharp cuts in quota had to be introduced in recent years. The Australian catch limit of 21 000 tonnes was reduced to a quota of 14 500 tonnes in 1984, 11 500 tonnes in 1986 and 6250 tonnes in 1988, causing considerable hardship within the industry and fishing communities. Scientists have suggested that the only 'safe' quota is zero.

However, a major problem with regard to the introduction of quotas has been the need to obtain agreement from Japan and New Zealand on reductions in their catches of SBT both in the AFZ and elsewhere. International management has presented considerable problems (Kearney 1991). Without international agreement Australia would lose from quota reductions without there being any potential long term benefit.

When Japanese scientists expressed concern over increases in the Japanese longline tuna catching effort, and the long term benefits of a reduction in this, the Japanese fleet refused to support such a reduction and continued to increase its catching effort throughout the 1970s (Caton 1987). The Japanese catch declined from the record level of 77 000 tonnes in 1961. The agreed catch limit for Japan was 23 150 tonnes in 1985, 19 500 tonnes in 1986, and 8800 tonnes in 1988.

The ITQ system has allowed producers to obtain a property right in the fishery and to trade this right. This should have led to economic efficiency and the generation of maximum profits. However, participants and researchers have expressed criticism of the way in which ITQs were introduced, with an unsustainably high TAC. Subsequent reductions in the TAC have led to losses on the part of fishermen who bought ITQs at prices which reflected expected profits based on a sustainable TAC, and an adjustment problem because of industry investment in boats and gear. In the period prior to the introduction of the ITQ system, the anticipated high prices for quota caused effort, which otherwise would have left for the SET, to remain in the fishery. This was because fishermen were waiting for their quota allocations which could subsequently be sold.

There is a perception in the industry that the managers of the fishery have managed it badly by failing to make gradual reductions to the TAC rather than drastic cuts. Mrs Anna Stehr of the Stehr Group (South Austalia) commented that:

> Our once thriving tuna industry has been consciously destroyed by government.....It is so frightening, frustrating and demoralising to watch your fishery and business collapse, and be helpless to take corrective measures. Whilst we all require management and are prepared to pay for it, we want productive, positive management that benefits all.

However, as explained previously, there are many causes of the problems which beset the SBT, including international disputes, differences between sections of the domestic industry and between the States, and scientific disputes. The Commonwealth Government's position has been difficult.

The decline in the tuna catch has had a significant impact on fishing communities and towns such as Port Lincoln in South Australia, where employment created by the local tuna fleet decreased dramatically.

The Master Fish Merchants' Association of NSW has also been very critical of the effects of quota arrangements, in part because of their effect in shifting the SBT catch towards younger, lighter and hence less valuable fish:

> In the early eighties, the introduction of ITQs to the Southern Blue-fin Tuna industry resulted in an 'overnight' transfer of quota from NSW to South Australia. This was disastrous for both fisheries management and for NSW. The SBT fishery is now concentrated in an area (off South Australia) where the fish are approximately two years old, as opposed to NSW waters where the fish are approximately four years old (due to their migratory pattern) and twice as big - a management debacle. For the few million dollars (windfall) paid to NSW fishermen for their quota, it has been estimated that NSW has since lost $200 million in revenue which would have been derived from catching and selling its share of the SBT catch.

However, it was the disappearance of surface schools of SBT from New South Wales which led to the cessation of the type of fishing practiced there, and the shift of the SBT industry to South Australia.

# G.5 FOREIGN FISHING

Foreign fishing interests are allowed access to resources in the Australian Fishing Zone on a commercial basis with payments for access, and under Treaty arrangements and special agreements. Much of the current foreign fishing access is a relic of historical fishing patterns that existed prior to the declaration of the AFZ. Foreign access is particularly important in the SBT fishery and for other tuna species.

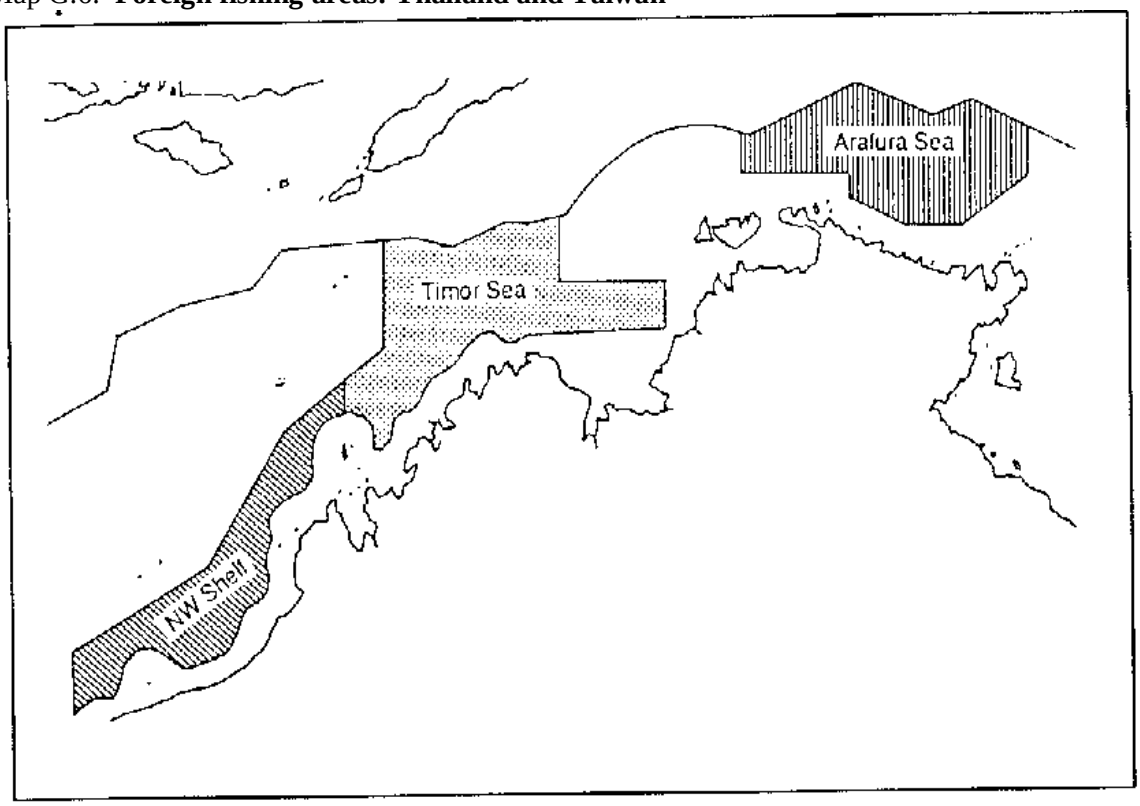
**Foreign fishing arrangements**

Foreign fishing operations in the AFZ have been progressively reduced in recent years. Aside from Japan, the fishing agreements listed in Table G.15, for the period up to 1990, have not been renewed. The Taiwanese ceased operations (for sharks and rays) in the northern Australian waters as of 31 October 1991.

A multilateral treaty between the United States, Australia and various Pacific island states was signed in 1987. The area covered by the treaty includes a small part of the AFZ in the Coral Sea. The treaty deals with purse seine fishing for tuna, and is administered by the South Pacific Forum Fisheries Agency.

Japan, Thailand and Taiwan have had a significant involvement in commercial fishing in the AFZ. The former USSR has been involved to a lesser extent. Japanese interests are involved along the west and north-west coasts, around Tasmania and parts of the east coast, mainly fishing for SBT and other tunas. The Thai and Taiwanese operations have been limited to the areas shown in Map G.6. Their catch comprised shark, stingrays and other fish, rather than tuna.

Map G.6: **Foreign fishing areas: Thailand and Taiwan**

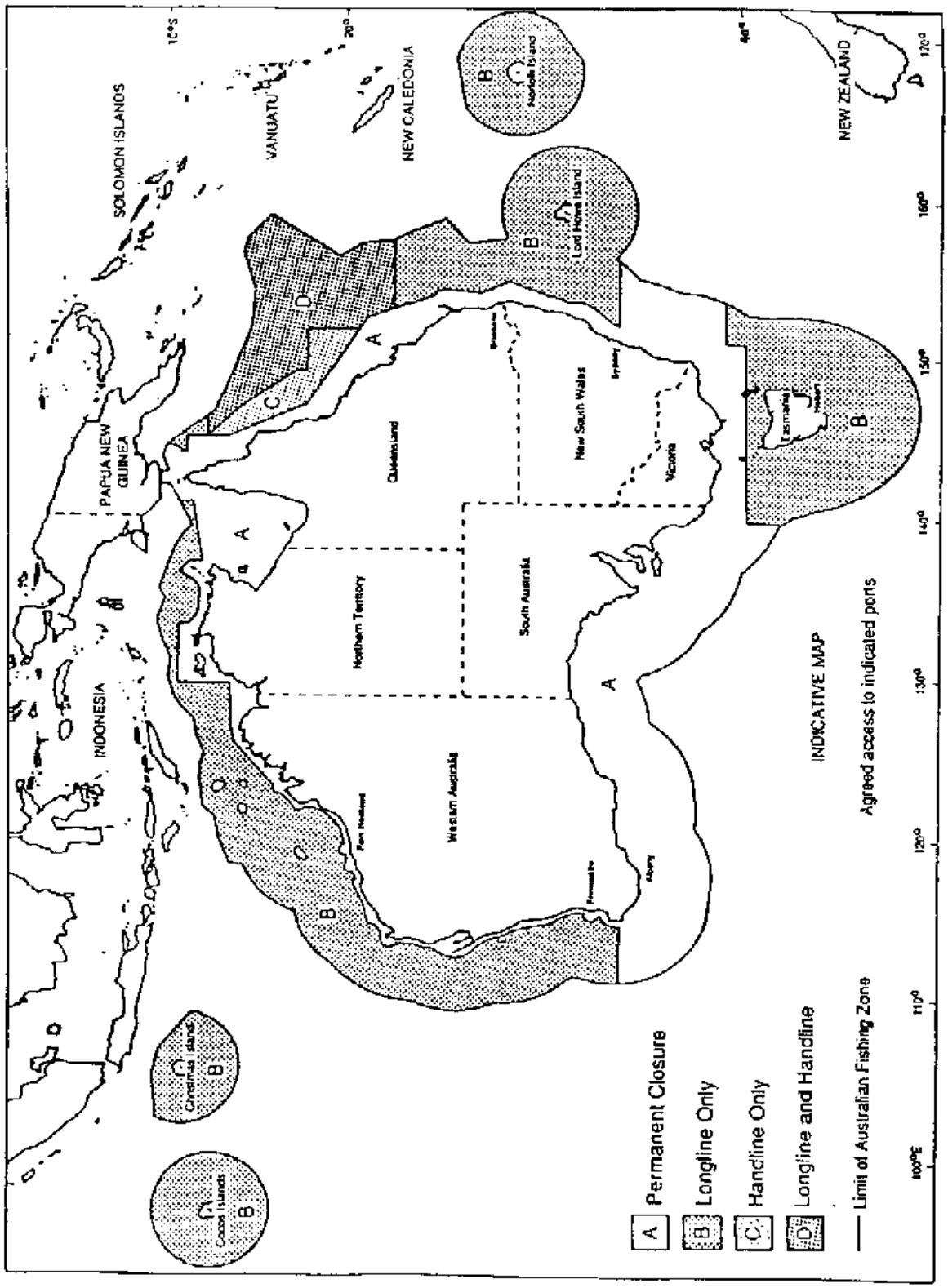



Source: Department of Primary Industries and Energy 1991, *Background Fisheries Statistics*, No. 5, Fisheries Paper 91/6, May, Canberra.

The Japanese longline fishing vessels operate in the AFZ as part of their global fishing operations. The main species caught are yellowfin, albacore, southern bluefin and bigeye tuna, billfish and marlin. Yellowfin tuna is the largest component, accounting for about a third of the total catch (see table G.15). The distribution of the catch, by species, varies considerably according to area. SBT is the main species caught around Tasmania, accounting for 85 per cent of the total catch in this zone.

Map G.7 presents details on areas which are open to Japanese fishermen and the restrictions which apply in some areas on the type of gear which may be used. Several areas have been closed to foreign fishing in favour of game fishing.

Map G.7: **Japanese fishing areas in AFZ**



*Foreign fishing in the AFZ*

The Taiwanese fished the northern waters of Australia long before the Australian Fishing Zone was proclaimed. Government to government fishing agreements between Taiwan and Australia have not been possible because of diplomatic requirements. For this reason Taiwanese fishing operations have been through joint venture arrangements with an Australian company acting as agent which undertook legal and financial responsibility for Taiwanese activities in the AFZ. The fishing agreement was between the Commonwealth and an Australian commercial organisation. The Kailis Kaohsiung Fishing Company Pty (KKFC) was formed from the Kaosiung Fishingboat Commercial Guild (the Taiwanese industry organisation), which acted on behalf of the Taiwanese government and the Australian Kailis Group.

A series of developments have led to the withdrawal of Taiwenese operations in the AFZ as of 31 October 1991. Because of the Commonwealth's concern for dolphin by-catch, a maximum 2.5 kilometre gillnet length came into effect. In 1986, Taiwanese gillnet operations ceased as the operations became unprofitable. In 1988, the focus of management plans shifted to fishing operations which would satisfy Australian markets at much reduced TACs. The introduction of the Northern Finfish Trawl Development Plan on 1 December 1990 ended Taiwanese pair trawling. For the two years 1990 to 1991, arrangements were in place for Taiwanese shark longline operations to explore and supply information of the shark stocks in northern Australian waters.

According to an Australian Fisheries Service manager (Dekker 1991, p. 27), the completion of the agreement with KKFC means:

> ...greatly reduced fishing pressure on the stocks as a result of the displacement of foreign vessels, higher catches in these northern fisheries should result in the development of a diversified and profitable Australian industry.

A voluntary trilateral agreement between Japan, Australia and New Zealand sets the global catch quota for SBT and individual country quota entitlements. A bilateral fishing agreement between Japan and Australia is made on a government to government basis, covering the Japanese exploitation of tuna in the AFZ. The bilateral agreement apportions the regional quota of SBT, so that in 1990-91, the quota of 2200 tonnes was divided between the Japanese (800 tonnes) and Australians (1400 tonnes). The new bilateral agreement for 1991-92 sets the Japanese share at 400

tonnes of SBT. The bilateral agreements did not set limits on the catches by the Japanese of other species. However, input controls were used to limit catch: the number of boats which could be licensed, which is set at 250 boats; and the number of boats which could operate in a specific zone at any one time. The new agreement introduces more stringent controls. The maximum number of boats permitted in the east coast (including Norfolk Island) was reduced from 60 to 50 and a limit of 9 million hooks was introduced. In the west coast (including Cocos and Christmas Islands), the maximum number of boats was reduced from 50 to 40 boats.

*Foreign involvement in Australian fishing operations*

Japanese fishing operations also have access to the AFZ through joint arrangements and charter arrangements, and include the ancillary operations of carrier/processor.

Commonwealth government agreements can be made directly with a specific country, or with Australian companies acting on behalf of foreign operators or in joint venture operations. For the purpose of these agreements the DPIE, in its submission, has defined an Australian boat as '...one owned and built, or lawfully imported into Australia. If therefore, an Australian company charters a foreign boat, then it is treated as a foreign boat and an agreement may be entered into in relation to that boat'. This means that Australian-flagged foreign boats are considered Australian under the Shipping Registration Act 19 however, these boats are considered 'foreign' under the Fisheries Act 1952, and therefore requires ministerial approval.

There is currently only one joint venture arrangement with a Japanese operator, the Tuna Longline Development Cooperation Pty Ltd, which is a joint venture between the Japan Tuna Federation and the Tuna Boat Owners Association of Australia. The joint venture arrangements employ Japanese-flagged Japanese boats, whereas the charter arrangements employ Australian-flagged Japanese boats. Both arrangements involve Australian quota and therefore are not subject to the access fees which foreign fishing operations are required to pay.

The charter arrangements require that four Australian cadets be employed on each boat. A labour agreement is negotiated with the Departments of Industrial Relations, Employment, Education and Training and Immigration Local Government and Ethnic Affairs.

Table G.15: **Foreign agreements and catch by foreign fishing vessels in the AFZ**

| *Agreement with* | *Tonnes* | *Recording period* |
|---|---|---|
| Japan | 1 413 (SBT)<br>2 796 (yellowfin)<br>1 867 (albacore)<br>1 028 (big eye)<br>1 798 (other tuna)<br>8 902 (total tuna) | 1 Jan 1990 to 31 Dec 1990 |
| Thailand (Seanorth) | 2 500 | 25 Oct 1989 to 24 Oct 1990 |
| Taiwan (KKFC) | 300 | 1 Nov 1989 to 31 Oct 1990 |
| China | 1 021 | 1 Mar 1988 to 28 Feb 1989 |
| Norway | 2 050 | 1 Nov 1989 to 31 Oct 1990 |

Source: Department of Primary Industries and Energy 1991, *Background Fisheries Statistics*, No. 5, Fisheries Paper 91/6, May, Canberra.

*Payment of fees*

Payment arrangements for foreign vessels include a licence fee, management costs and an access fee (refer Table G.16). Management costs include surveillance and enforcement, including the observer program whereby observers are placed on foreign vessels, research, and administration. AFS has sought full cost recovery from foreign operators in the AFZ.

In 1989-90 the Japanese had paid $5.7 million for access to tuna in the AFZ, which included up to 1800 tonnes of SBT (this was calculated as 6 per cent of the average gross value of the catch). In 1990-91 the access fee was increased as a result of an ABARE study which indicated that the Japanese were paying less than their value of access (ABARE 1991, p. 5). The total fee paid by the Japanese in 1990-91 was $6.98 million for all tuna from the AFZ, including up to 800 tonnes of SBT. Table G.16 disagregates the total fee paid by Japan into management fees of $2.99 million and access fees of $3.99 million for 1990-91. Since Australia-Japan joint ventures and charter operations employ Australian quota held by Australians, access fees are not collected by the Commonwealth.

The total fee payable for 1991-92 under the Australia-Japan bilateral tuna longline Subsidiary Agreement was set at $3.8 million. In this agreement, Japanese access to SBT was reduced to 400 tonnes and further input restrictions were applied in the other tuna fisheries. The fee was divided into three areas: for the east coast region the total fee was set at $2.1 million; in the west coast region the fee was set at $0.3 million; and in the Tasmanian region the fee was set at $1.29 million.

Australia contributes to the funding of the South Pacific Forum Fisheries Agency, through the Australian International Development and Aid Bureau (AIDAB). In 1990-91 the Australian contribution paid through AIDAB was approximately $931 000. Australia received a treaty access fee of $140 000 for 1990-91 (refer to Table G.16), this amount being credited to AFS accounts.

In part of 1989 and 1990 three foreign vessels were granted approval to fish in the Great Australian Bight developmental fishery. This involved the same terms and licence endorsement fee of $6000 required from Australian vessels.

Table G.16: **Fees collected under foreign fishing arrangements - 1990-91[a] ($A million)**

| *Agreement with* | *Licence fee* | *Management costs* | *Access fee* | *TOTAL b* |
|---|---|---|---|---|
| Japan | 0.02 | 2.97 | 3.99 | 6.98 |
| KKFC Pty Ltd (Taiwan) | 0.01 | 0.34 | 0.05 | 0.40 |
| US-South Pacific Forum Treaty | 0 | 0 | 0.14 | 0.14 |

a) In addition to these fees in 1991, Seanorth Pty Ltd from Thailand paid $1 895 for 1 Foreign Fishing Boat Licence, 1 Foreign Carrier Boat Licence and 1 Master Fishermen's Licence, and $64 000 management levy. A Japanese/Australian Joint Venture also paid a management levy of $98 000. Neither of these are still current, but they appear in the 1990-91 accounts. b) For the periods 1990-91 under US-South Pacific Forum Treaty, 1 November 1990 - 21 October 1991 under the agreements with Japan, and KKFC. The US Treaty commenced in June 1988 and runs until June 1993.

Source: Department of Primary Industries and Energy.

*Access without payment*

As discussed in the section on the Torres Strait, a limited number of PNG vessels are allowed access to Australian waters in the Torres Strait Protected Zone under Treaty Arrangements. These arrangements also allow for some, but more limited, access by Australian fishermen to PNG waters in the Torres Strait.

A 1974 Memorandum of Understanding (MOU) between Australia and Indonesia allows traditional Indonesian fishermen to operate in certain areas of the AFZ in north-west Australia. In 1989 a meeting held between Australian and Indonesian officials agreed that the definition of 'traditional' fishermen was to refer to fishermen who do not use motor-powered vessels or mechanised forms of fishing. The meeting also agreed upon practical guidelines which simplify Australian surveillance and enforcement procedures.

**Surveillance**

Surveillance costs are included in the management costs ascribed to foreign fishermen. In addition to surveillance and enforcement measures, there is an observer program, whereby observers are placed on foreign vessels to ensure that they are complying with the terms under which they have been granted access. The cost of placing observers has amounted to some $1.5 million annually.

*Illegal fishing by foreign vessels*

Foreign vessels are from time to time apprehended for fishing illegally, or under-reporting their catch. A number of Japanese vessels have been involved, as well as Indonesian vessels in northern waters, and a Panamanian registered vessel with a Korean crew, off the Cocos islands.

Japanese vessels have been forfeited and/or fines paid for transgressions. The value of these fines and forfeits amounted to over $5 million 1990, but would not normally be expected to reach such a level. The moneys so raised go to consolidated revenue.

A controversy has arisen recently over the catching of sharks for their fins by Japanese tuna vessels off Western Australia. While incidental catches of sharks and other finfishes are permitted under the terms of the access agreements, targeting sharks for their fins is not permitted.

**Participants' views on foreign access**

Some participants were critical of the access granted to foreign fishing vessels, arguing that resources should be conserved for Australian interests. Representatives from the Northern Prawn Fishery argued that it is a mistaken premise that '....if a coastal nation is unable to fully exploit its resources other nations should be allowed access'. It said that the access the government has allowed to foreign fishing vessels in the SBT, North and North-West Trawl '...has depleted fish stocks and prevented Australian fishers from receiving the benefits'.

Dr Russell Reichelt of the Bureau of Rural Resources (BRR) expressed the view that granting access to foreign fishermen to Australian resources is a means of gaining information on these resources:

> ...one of the reasons for allowing that access is to learn something about our own resources, not simply to profit from them. That is another important reason for letting foreigners use our resources.

However, Dr Reichelt qualified this thus:

> ...if a foreign user of the resource is willing to pay a certain amount of dollars, and presumably at a profit to themselves, but those amount of dollars are not sufficient for us to monitor their activities and learn about our resources, I would put the view that the country should not allow that exploitation to occur.

Other participants raised the issues of the adequacy of the access payments made by foreign fishermen, and the principle of whether they should be given access. Mr John McGovern of the West Coast Crayfishermen's Association described the payments as 'totally inadequate' and 'a pittance compared to the profits made'. Mr Bruce Downie, President of the Game Fishing Association of Australia submitted that:

> ...it seems strange to me that we are encouraging foreign vessels into this marine desert when we could, with a little encouragement, expand our commercial fishery to make it more efficient and more successful.

Criticisms made of foreign fishing arrangements in the AFZ mainly concern Japanese access for SBT. The most important one is that quotas have not been reduced to prevent over-exploitation of the biomass. A further criticism is that the access fees paid have been less than the profits which the Japanese industry has obtained from this access.

In 1990, ABARE estimated the value to Japan of access to the AFZ as being at least $12.3 million, based on the tonnage caught in 1989. In contrast, $4.6 million was paid in 1989 for access to the AFZ.

The ABARE study estimated the expected annual value to Japan of catching SBT under the joint venture arrangements as 'possibly approaching' $16 500 per tonne. In contrast, the price paid by the Japanese to lease Australian quota in 1989 was $1987 per tonne. ABARE postulated that the lease price may have been reduced somewhat to offset an outstanding debt to the Japanese by the Australian Tuna Boat Owners Association of $2.5 million. The 'effective price' after the debt was amortised was estimated at around $2800 per tonne.

However, the ABARE study used as a basis for its estimates the average price for SBT received at Yaizu in Japan. Given the higher prices attracted by fresh product, and as SBT caught by Japanese vessels in the AFZ is shipped frozen to Japan, it seems questionable that it would obtain the average market price. Prices received for individual SBT consignments from Ulladulla in 1991 varied from $2 to $200 per kilogram, with the price obtained for most of the product being below the average. Hence the average Yaizu price may not be a reliable indicator of returns for SBT caught in the AFZ.

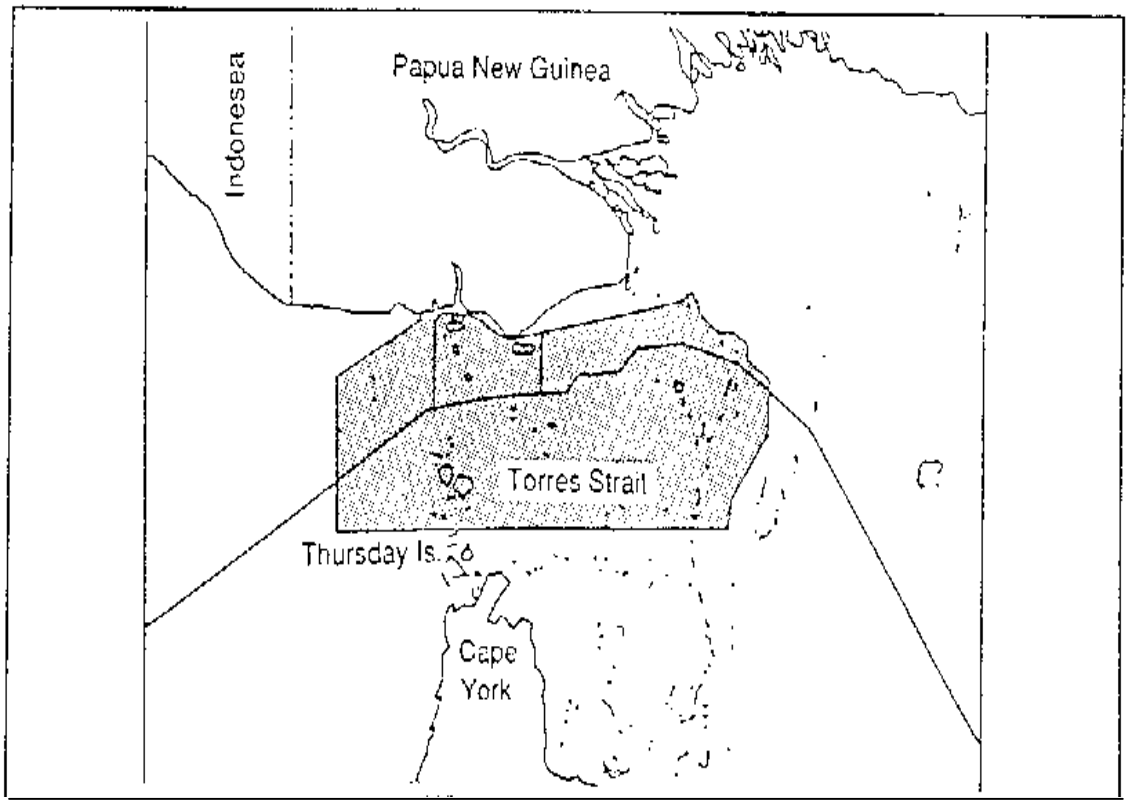
# G.6 THE TORRES STRAIT PROTECTED ZONE (TSPZ)

**Location**

The traditional fisheries in the Torres Strait are located in Australian territorial waters between the north of Australia and Papua New Guinea (PNG) (refer Map G.8).

There are some 70 islands in the Strait, of which l7 are inhabited by Islander communities. Of some 7000 Torres Strait Islanders, around 3500 live on the 'outer' islands and approximately the same number on Thursday and Horn Islands, close to Cape York. A further 1000 Torres Strait people live at Bamaga on the Australian mainland. Some 12 000 Torres Strait people live on the Papua New Guinea side of the Strait.

Map G.8: **The Torres Strait fishery**




Source: Australian Fisheries Service 1990, *Background Fisheries Statistics*, Department of Primary Industries and Energy, Canberra.

## Catch

*Prawns*

The prawn fishery is located mainly in the North East Channel area of the Torres Strait Protected Zone. In 1990 there were 130 boats involved in the industry. Total employment included 450 in catching and 200 in processing, with the main port being Cairns. Most of the product is exported, with the main market for the prawns being Japan. In 1989 commercial catches of 532 tonnes of tiger prawns, 607 tonnes of endeavour prawns and 25 tonnes of king prawns were reported. The fishery is considered to be fully exploited. According to ABARE preliminary estimates the value of the catch in 1990-91 was $16.2 million (ABARE 1991b).

*Rock lobster*

Only half of the catches of rock lobster are commercial, the remainder are artisanal catches. In 1989-90, commercial fishing accounted for some 200 tonnes of tropical rock lobster, of a value of some $5 million. The main market for the product is the United States. The fishery is considered to be in a stable state and possibly able to withstand a higher degree of exploitation.

*Spanish mackerel*

Commercial catches of Spanish mackerel totalled 109 tonnes in 1989, out of a TAC of 300 tonnes. The fishery is not considered to be fully exploited. Mackerel is often fished as a secondary or tertiary species.

*Pearl shell*

Pearl shell from pearl oysters is not considered to be abundant. The present catch amounts to some 3000 - 3500 shells per annum and is mainly incidental to lobster and trochus fishing. The spilling of oil from the sinking of the 'Oceanic Grandeur' oil tanker in 1970 substantially damaged grounds. There was a continued decline in production, but recent indications are that the pearl beds are re-establishing themselves (TSPZJA 1990).

*Dugong*

Only traditional fishing for dugong is permitted in the TSPZ. A survey in 1987-88 estimated the population to be 11ÿ000 to 14ÿ000 individuals. Even with catches restricted to traditional fishing, there is evidence that dugong numbers in the Torres Strait have declined and that in the absence of suitable management initiatives dugongs could become rare or extinct in the area (TSPZJA 1990).
Turtles

Commercial fishing for turtles is prohibited in the Australian part of the TSPZ. Green turtles are the main species caught. While their numbers are in decline on a global basis, traditional catchings in the Torres Strait are not considered to be a major contributor to this decline.

## Management

*Jurisdiction*

The Protected Zone Joint Authority (PZJA) has jurisdiction over the Australian component of the TSPZ. It is a body with joint representation of the Commonwealth and Queensland State Governments. Its responsibilities, operations and finances are discussed later in this section. The PZJA manages the following fisheries for the Commonwealth in the Australian component of the TSPZ (TSPZJA 1990, p. 1):

> (a) traditional fishing;
>
> (b) those fisheries which Australia and Papua New Guinea have agreed to jointly manage in the TSPZ under Article 22 of the Treaty: prawns, Spanish mackerel, pearl shell, tropical rock lobster, dugong and turtle; and

(c) the barramundi fishery in the territorial waters adjacent to the six Australian islands near the Papua New Guinea coast: Saibai, Boigu, Moimi, Kaumag, Aubusi and Dauan.

All other commercial fisheries, and recreational fishing, are managed by Queensland except for fishing by operators of foreign boats. Access for foreign boats consists of the specified agreed access for certain PNG boats discussed below.

*Treaty arrangements*

Treaty arrangements between Australia and PNG allow for a division of fisheries and seabed rights between the two countries. They also allow for the free movement of the traditional inhabitants within the TSPZ in order to carry out their traditional activities, including fishing (Haines, Williams and Coates 1986).

Arrangements have been agreed upon by Australia and PNG for the TSPZ in order to fulfil the Treaty obligations. The Treaty recognises the rights of both countries to the commercial fisheries of the TSPZ. Catch sharing arrangements in the prawn, crayfish and pearl shell fisheries determine each country's share through a 75 per cent - 25 per cent access to an 'Allowable Catch' from its respective jurisdiction, with a 50 per cent - 50 per cent share in territorial waters adjacent to certain Australian islands. Elmer and Coles (1990, p. 3) state that:

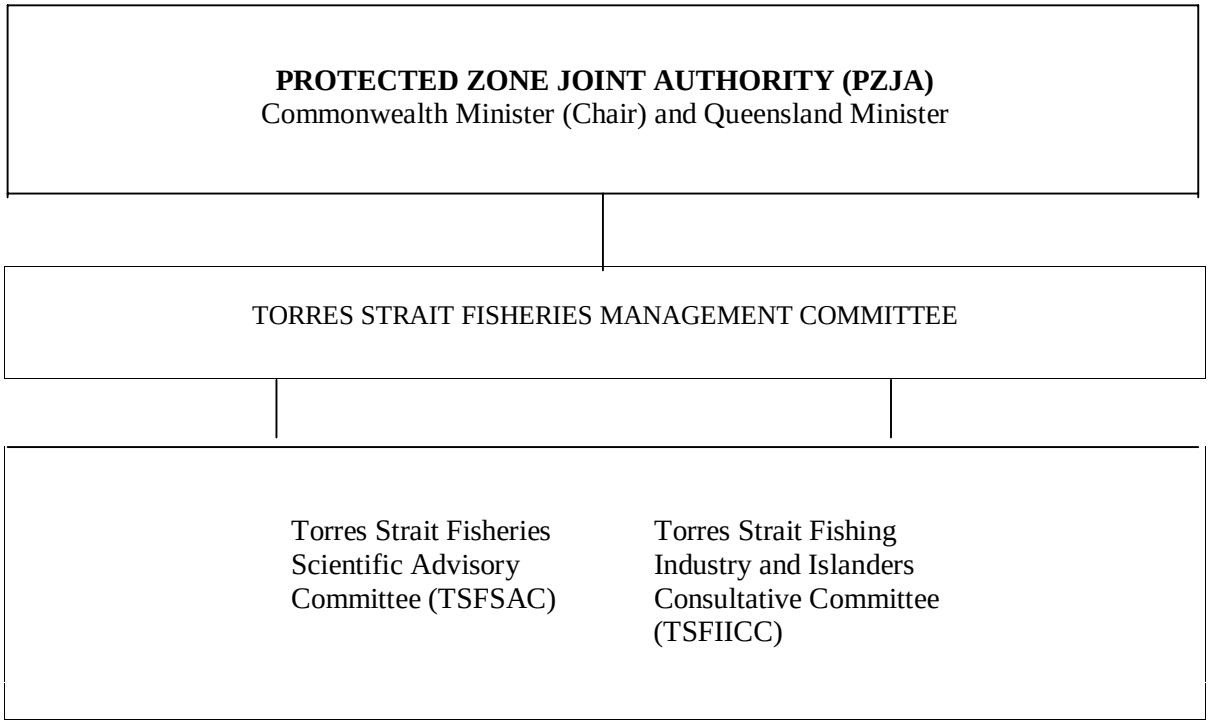
> Initial schemes for catch sharing on a catch quota basis for each fishery proved extremely difficult to implement. A scheme is now agreed and in place based on input control, i.e. a number of vessels, the number of which can be adjusted on an annual basis given the experience of average catches per day of the 5 preceding years. Both countries have agreed to this net sharing scheme whereby one country nominates a number of vessels to fish in the other's waters estimated to be sufficient to take the net catch intended by the Treaty for each fishery.

Up to nine prawn trawlers and 27 lobster dinghies from PNG are allowed to operate in the Australian side of the Zone, with one trawler and three pearl shell fishing boats from Australia being allowed to operate on the PNG side.

PNG agreed to implement area and seasonal closures of fisheries to complement Australian closures to protect juvenile prawns, and to adopt Australian restrictions on the size of pearl shells. It was also agreed by both countries to maintain the lobster fishery as a dive-only fishery, to retain existing bans on gillnetting, and to continue to allow only the traditional inhabitants to take dugong and turtle (Australian Fisheries 1990b, p. 9).

PNG licensed vessels have been banned from operating in the TSPZ outside these arrangements. Boats are not allowed to have 'dual nationality', therefore they cannot take refuge in the other country to escape apprehension, if they offend against one country's laws.

Figure G.7: **The structure of PZJA management bodies**




Source: Torres Strait Protected Zone Joint Authority (TSPZJA) 1990, *Torres Strait Protected Zone Joint Authority Annual Report 1989-90*, Department of Primary Industries and Energy, AGPS, Canberra.

*Membership of the PZJA*

The membership of the PZJA comprises the Commonwealth Minister for Primary Industries and Energy (Chair) and the Queensland Minister for Primary Industries. The PZJA has established a number of advisory bodies with industry, Islander and government representatives, as shown in Figure G.8.

*Traditional fishing*

Local communities undertake traditional fishing on which they rely to a high degree for a source of food, catching fish, dugong, turtles, and collecting trochus shell. Some of the products, for example pearl shell and trochus, are sold.

*Commercial fishing*

Commercial fishing in the Torres Strait is mainly for prawns and rock lobster. It accounts for around half of total Torres Strait catches of lobster, and most of the prawn catch. Management rules limit the operation of trawlers. Only a certain number of licences and licence endorsements are issued; there are closures at certain periods and a ban on daylight trawling. Only a proportion of the potential catch of rock lobster is harvested, which aims to ensure that adequate stocks remain for artisanal fishing.

The Treaty arrangements require a TAC to be set for commercial fisheries, based so far on historical catch. The annual life cycle of prawns and temporal variations in their abundance make it extremely difficult, if not impossible, to set realistic TACs (Haines, Williams and Coates 1986).

As at 30 June 1990 there were 806 Master Fishermen's Licences and 476 boat licences in force in the TSPZ. They are endorsed for a variety of fisheries (see Table G.18). As discussed below, reductions in licence numbers are being used as a means of reducing fishing effort.

*The aims of fisheries management in the TSPZ*

The major objectives of fisheries management in the TSPZ include the meeting of Treaty obligations with PNG, such as the protection of the way of life and livelihood of the traditional inhabitants (Haines, Williams and Coates 1986), and the management of commercial fishing activities to ensure resource conservation and maximisation of Islander participation.

Table G.17: **Licences issued for joint authority fisheries**

| *Type of licence* | *Number of licences* |
|---|---|
| Master fishermen's licences in force at 30 June 1990 | |
| Prawns | 425 |
| Rock lobster | 30 |
| Mackere | l39 |
| Prawns and mackerel | 18 |
| Prawns and pearl | 1 |
| Prawns, lobster and mackerel | 1 |
| Prawns, lobster, mackerel and pearl | l5 |
| Rock lobster and mackerel | 59 |
| Rock lobster and pearl | 27 |
| Rock lobster, pearl and mackerel | 188 |
| Pearl | 10 |
| Mackerel and pearl | 3 |
| Total | 806 |
| Boat licences in force at 30 June 1990 | |
| Prawns | 130 |
| Rock lobster | 71 |
| Pearl | 10 |
| Mackere | l50 |
| Prawns and mackerel | 3 |
| Rock lobster and mackerel | 42 |
| Rock lobster and pearl | 49 |
| Rock lobster, pearl and mackerel | 121 |
| Total | 476 |

Source: Torres Strait Protected Zone Joint Authority (TSPZJA) 1990, *Torres Strait Protected Zone Joint Authority Annual Report 1989-90*, Department of Primary Industries and Energy, AGPS, Canberra, p. 5.

As already indicated, one of the aims of the PZJA is to maximise the opportunities for Islander participation in all sectors of the fishing industry. Non-Islander involvement is well established in the commercial fisheries, particularly the prawn fishery. However, the PZJA has sought to prevent it expanding further in fisheries where there may be scope for additional growth, for example the tropical rock lobster, mackerel, barramundi and pearl shell fisheries. One commercial prawn

trawler licence and two non-dedicated commercial catching boat licences have been offered to traditional inhabitants on a non-transferable basis, with the requirement that the vessels would be operated and manned by traditional inhabitants exclusively except in the circumstance where non-Islander operators undertake approved training of Islanders.

Islanders can participate freely in the rock lobster dive fishery, but require a licence to operate a community (Islander) boat over 6 metres in length.

The PZJA has a long-term policy of effort reduction in the commercial fishery to be achieved through a freeze on licence transfer. The fishery is considered to be over capitalised (Elmer and Coles 1990). During 1990, a 10 per cent reduction was achieved. When licence holders leave the fishery, the licence ceases to exist, subject to certain exceptions (Arthur 1990). Transfers are permitted to spouses or children on death or permanent incapacity, and for companies or partnerships when 20 per cent of the capital is transferred to the spouse or child of a shareholder on the death of that shareholder. It has been suggested that in the future, when licences change hands, there could be a restriction on the transfer or sale of the Torres Strait endorsement to anyone other than an Islander, resulting in a possible estimated transfer of 90 per cent of licences over ten years (Arthur 1990).

Non-Islanders involved in the commercial fishery have suggested that Islanders may not be keen to work in it because the trawling is mainly done at night, and that employers prefer to hire crew who will be a long way from home and committed to working the eight month season (Arthur 1990).
The fishery is closed between 1 December and 1 March in order to allow young prawns to grow to an economic size for catching. There is a permanent closure in the region to the west of Warrior Reef and a one month seasonal closure on the eastern side of that reef. These closures around the reef limit catches of low quality prawns while protecting important seagrass and juvenile prawn nursery grounds. The fishery has a ban on daylight trawling to protect lobsters and to reduce fishing effort.

The PZJA is seeking to contain the growth in non-Islander involvement through boat replacement policies, restrictions on the issue and renewal of licences held by non-Islanders, and reductions in the number of fisheries a licence is endorsed for.

An education program has been undertaken to encourage a cautious long-term approach to the harvesting of dugongs, with a similar program to be undertaken for turtles.

No commercial licences are to be issued for barramundi. The stocks are to be retained entirely for the benefit of the traditional inhabitants undertaking community or artisanal fishing.

*Cost sharing arrangements*

A January 1986 cost sharing agreement between the Commonwealth and Queensland Governments sets out the principle that the Commonwealth and Queensland share equally the recurrent costs of managing PZJA fisheries. The Commonwealth fully funded initial capital items, which included boats and equipment for surveillance and other purposes, but the Commonwealth and Queensland will share equally the cost of replacement of initial capital and further capital items. The cost sharing arrangement in 1989-90 is shown in Table G.19.

A total of $286 040 was allocated by AFS in its budget for 1990-91 to cover the costs of participation in management of the Torres Strait fishery in terms of running costs and salary payments. Of this, $145 440 was for salary payments and $114 600 for running costs. A further $960 000 was allocated for capital items. No provision was made for that year for recovery of management costs from the commercial fishery, other than from licence fees.

*Surveillance*

Surveillance is needed to ensure that foreign vessels fishing in the Torres Strait can be apprehended, and that only Australian boats with licences to fish in the Torres Strait do so, and that they comply with the conditions imposed by their licences. The Queensland Boating and Fisheries Patrol is charged with the responsibility for enforcing management arrangements in the TSPZ.

Table G.18: **Torres Strait expenditure 1989-90**

| *Item* | *Cost in $* |
|---|---|
| Initial capital items (including Commonwealth contribution) | 407 585 |
| Replacement capital items (Queensland Funded) | 60 100 |
| Recurrent costs: | |
| Commonwealth | 1 120 665 |
| Queensland | 1 052 103 |
| Torres Strait Research and Monitoring Program: | |
| Commonwealth funded | 412 000 |
| Queensland funded | 345 085 |
| Total expenditure | 3 475 538 |
| Less disposal of capital items | 20 100 |
| Total expenditure less offsetting revenue | 3 455 438 |

Source: Torres Strait Protected Zone Joint Authority (TSPZJA) 1990, Torres Strait Protected Zone Joint Authority Annual Report 1989-90, Department of Primary Industries and Energy, AGPS, Canberra, p. 5.

Surveillance against the entry of foreign vessels is provided by the Coastwatch program. This surveillance is also undertaken for various other purposes such defence, immigration, customs and quarantine. A 25 metre vessel, capable of 22-25 knots, the 'Wauri', is used for fisheries protection in the TSPZ. It is also used to some extent for transport and accommodation of immigration, quarantine and health service officers. The alternative to the use of the vessel, by not only fisheries but also the other agencies, would be helicopter use and on-shore accommodation for personnel. This use by other services is also as part of Treaty obligations between PNG and Australia. It also achieves some defence aims, for which a special boat would otherwise be needed. However, fisheries agencies pay for it and as such determine its deployment; they are trying to cut the voyages involved and prune its operations, or reduce costs by using it for fisheries protection outside the TSPZ.

AFS paid for the acquisition of the 'Wauri'. Queensland manages and staffs the vessel, the operating cost being shared by the Commonwealth and the Queensland State Government on an equal basis. The Commonwealth's half of the operating cost comes out of the budget of the Department of Primary Industries and Energy (DPIE) through AFS. The replacement cost of the vessel is some $3.85 million, with the vessel having cost under $2 million. A top quality vessel such as this is needed because there is no infrastructure in the area which would allow repairs to be made easily.

Some 30 per cent of human resources involved in surveillance are dedicated to extension and community education efforts (Elmer and Coles 1990). Voluntary compliance is sought through education and extension efforts before legal mechanisms are resorted to.

Enforcement is required to control exploitation not only by commercial operators but also illegal foreign fishermen. Several Indonesian fishing boats are apprehended for illegal fishing each year. Their catch includes trochus, shark fin, reef fish and turtles. Fines and confiscation of boat, catch and equipment are the usual penalties imposed.

*Research*

Actual expenditure contributed to Torres Strait research by AFS amounted to $412 000 in 1989-90. In 1990-91 the Commonwealth contribution to budgeted expenditure was $652 000. The estimated budget for AFMA for 1991/92 includes an allocation of $813ÿ000 for Torres Strait research.
In 1988-89 the following research projects and expenditure were undertaken by CSIRO for the Commonwealth in the TSPZ:

- effects of prawn trawling on fish abundance in the Torres Strait - $246 000;
- biology of the tropical rock lobster - $122 000; and
- seasonal and interannual variability in seagrass in the Torres Strait - $44 000.

The Queensland Government provided $345 085 for a study of the Torres Strait prawn resources.

The research undertaken assists the TSPZJA in determining whether fish stocks and dugong and turtle numbers are declining, and hence whether there is any threat to the continued livelihood and way of life of the Torres Strait Islanders, as well as determining maximum sustainable yields from commercial fisheries.

**Assessment of management**

Any assessment of management has to be made in the light of one of the major objectives of the TSPZJA, the preservation of the way of life and livelihood of the traditional inhabitants, which arises from the provisions of the Torres Strait Treaty. In pursuance of this objective the TSPZJA has taken relevant actions to freeze non-Islander commercial fishing activities, to encourage greater Islander participation and control in the commercial fishing industry, and to undertake surveillance and research in order to preserve the fish resources of the area. In undertaking these activities it has made progress towards the achievement of its objectives.

Fisheries management arrangements have not been such as to maximise economic efficiency, because they have had to be aimed at the major objective of the TSPZJA of maintaining the livelihood and way of life of the traditional inhabitants. The TSPZ has been taking steps to increase Islander participation in the fishery and to reduce outside commercial involvement. This operates to increase local involvement, which could have higher operating costs than commercial operators. The commercial prawn fishermen are mainly based in Cairns and operate to optimise economic advantage in a number of northern fisheries, with the period spent in the Torres Strait representing only part of the usual trawling voyage.

Professor H.F. Campbell, Professor of Economics at the University of Tasmania, submitted that ITQs or licences should be allocated to aboriginal groups where it is desirable or necessary to recognise traditional rights, along the lines of the allocation of quotas to Maori interests in New Zealand. However, unlike the Maori population of New Zealand, the Torres Strait Islanders have not had substantial involvement in the commercial fishing industry. The social benefits of present TSPZJA arrangements which allow for a gradual increase in the involvement of the traditional inhabitants in the commercial prawn fishery may lead to greater net economic gains than could be obtained from the sale or leasing of all rights to outside commercial operators.

One area in which the TSPZJA may not have been successful in maintaining a traditional resource is with respect to dugongs and green turtles. However, the TSPZJA has undertaken data collection and education programs to permit monitoring of dugong numbers. Notwithstanding the fact that dugongs may only be taken by traditional fishermen, some management initiative may be necessary to reduce the catch in order to sustain the resource. With regard to green turtles, they are declining on a global basis. Commercial catchings are not permitted in the TSPZ. It is not clear that attempts to reduce the traditional catch in the TSPZ could have any effect on local numbers.

# G.7 GREAT CARRIER REEF

The Great Barrier Reef Marine Park is managed by the Great Barrier Reef Marine Park Authority (GBRMPA) whose primary objective is protection of the natural environment of the Reef. Uses are permitted to the extent that they do not conflict with this objective. These include commercial and recreational fishing and tourism.

*Location*

The Region extends from the tip of Cape York in the north to between Gladstone and Bundaberg in the south and eastwards from the low water mark on the Queensland coast (see Map G.10).

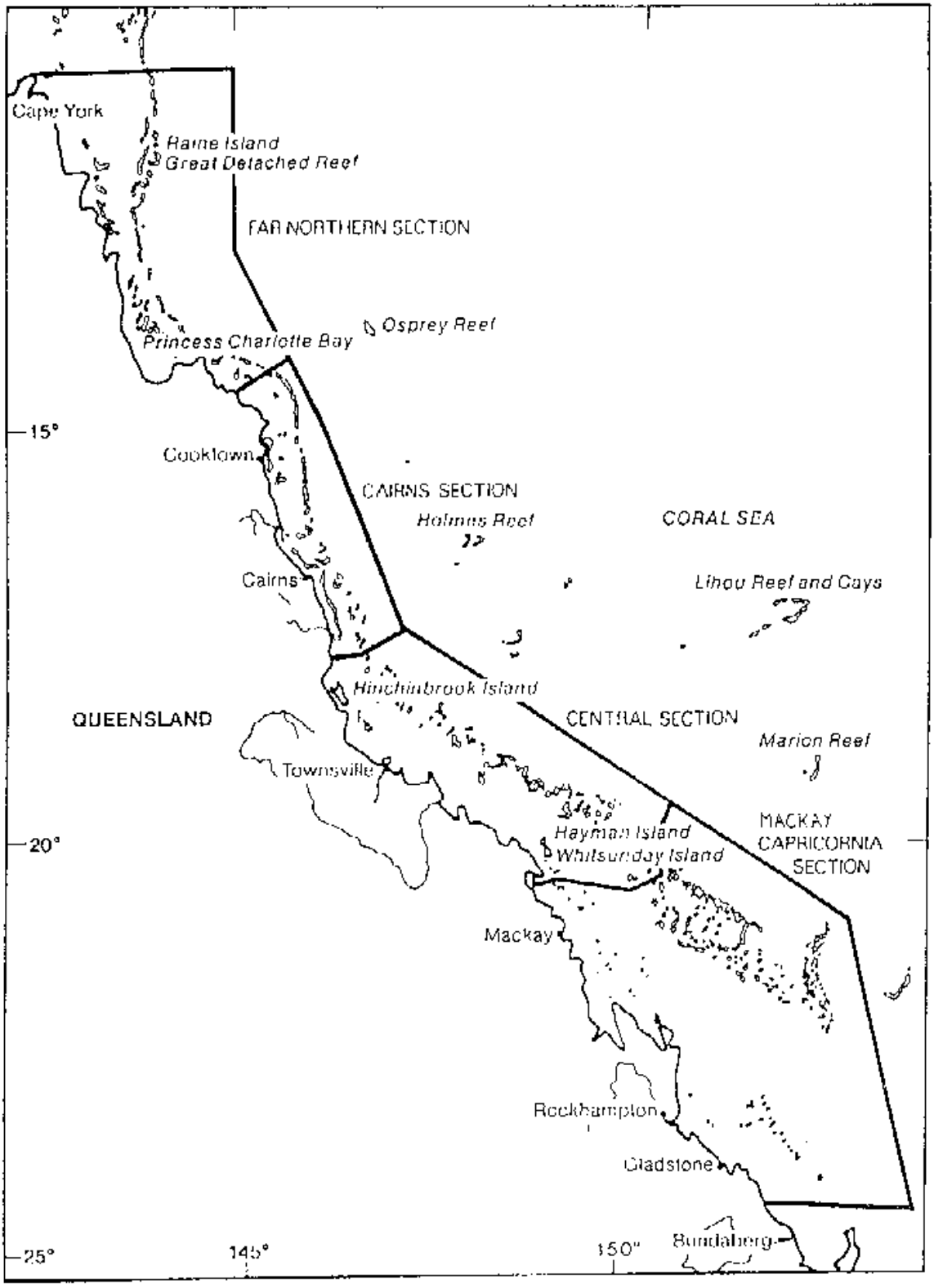
The Reef is the largest system of corals and associated life forms in the world, covering an area of approximately 350 000 square kilometres. It stretches for almost 2200 kilometres along the Queensland coast. There are approximately 2900 individual reefs. Reef wildlife is abundant and diverse. There are about 1500 species of fish, six species of turtles and about 350 species of hard corals, while its islands are inhabited or visited by more than 240 species of birds. The Reef is also one of the last places on Earth in which dugongs are still common.

The Reef and its waters have long been used as a source of food by coastal aboriginals. More recently they have been used not only as a source of food caught by commercial and recreational fishermen but also for recreational purposes and tourism.

*Management of fisheries and other uses*

GBRMPA was established by the The Great Barrier Reef Marine Park Act 1975 and given the task of managing the Reef as a multiple-use marine park. GBRMPA operates in conjunction with Queensland National Parks and Wildlife Service (QNPWS) to conserve the Great Barrier Reef while allowing reasonable use. GBRMPA must prepare zoning plans for the Marine Park which have regard for:

Map G.9: **The Great Barrier Reef Marine Park**



(a) the conservation of the Great Barrier Reef;

(b) the regulation of the use of the Marine Park so as to protect the Great Barrier Reef while allowing the reasonable use of the Great Barrier Reef Region;

(c) the regulation of activities that exploit the resources of the Great Barrier Reef Region so as to minimise the effect of those activities on the Great Barrier Reef;

(d) the reservation of some areas of the Great Barrier Reef for appreciation and enjoyment by the public; and

(e) the preservation of some areas of the Great Barrier Reef in its natural state undisturbed by man except for the purposes of scientific research.

GBRMPA submitted that it:

> ...is responsible for care and development of a Marine Park within the Great Barrier Reef Region. The object of the Marine Park is conservation of the Reef. Reasonable use of the Reef must also be ensured in the development of zoning plans and management plans. Zoning plans spatially regulate the usage of the Marine Park and each plan provides for five or six zones ranging from virtually unrestricted activity to small areas into which entry is prohibited except for the purposes of scientific research.
>
> The Marine Park, in its zoning plans, does not distinguish between commercial and recreational fishing activities specifically although it recognises that trawling which may only occur in General Use A zone is only a commercial activity and that commercial fishermen are unlikely to wish to fish in the Marine National Park 'A' zones where an objective is limited fishing.

The Great Barrier Reef Park is a multiple use managed area rather than a strict National Park as on land. Under its legislation GBRMPA, in drawing up zoning plans for the usage of the area, must take into account all existing uses.

The primary goal of the GBRMPA is:

> To provide for the protection, wise use, understanding and enjoyment of the Great Barrier Reef in perpetuity through the development and care of the Great Barrier Reef Marine Park.

To help fulfil this objective, the managers have developed a set of guiding principles. These are: public participation in the planning and management processes; environmental education; minimal regulation and interference in human activities; minimal cost of management; and flexibility of management.

GBRMPA has no direct involvement in fisheries management, which is undertaken by the Queensland Fisheries Management Authority (QFMA). However, GBRMPA 'has considerable control over the areas which may be fished and the choice of these is balanced with the areas in which other activities may occur'. GBRMPA sees its policy of relevant closures as having conservation objectives:

> The end result of this strategy of ... is that even if fisheries are over fished, there will be areas within the Marine Park which could be regarded as refuges for organisms and possibly as sources to supply adjacent areas for the fishery.

GBRMPA's closure strategy is on a longer term basis than would normally be undertaken for fisheries management objectives:

> The difference between closed areas in the Marine Park and areas closed under fishery management strategies in the past seems to be the period for which these areas are closed. Frequently, areas are closed for short periods of time by fisheries managers whereas in the Marine Park areas are closed for a period of at least five to seven years, and maybe much longer if they remain closed under successive zoning plans.

GBRMPA has also undertaken television advertising programs in order to educate recreational fishermen into not taking more fish than are needed for their personal consumption, and not disposing of garbage at sea.

QFMA is proposing to introduce a range of management controls specifically for the Great Barrier Reef. For commercial fishing entry is to be limited and fishermen will require a separate endorsement. Size limits are to be introduced for 36 species of fish. Recreational fishermen will have to comply with catch quotas on 26 species which will limit the number of fish that you can have in your possession. The catch quota will vary according to species. In addition there will be an overall limit on the number of fish subject to quota that can be taken. QFMA also intends to introduce a licence for charter boat operators and a system of log books.

*Surveillance and enforcement*

In managing fishing activities in the Marine Park through such strategies as joint management plans, zoning plans, and permits for collecting purposes, GBRMPA undertakes a range of activities with the aid of other agencies, organisations and individuals:

> ...aerial surveillance (both Coastwatch and Queensland National Parks and Wildlife Service (QNPWS) vessel patrols, using both QNPWS and Qld Boating and Fisheries Patrol (QBFP)), enforcement (QNPWS, QBFP, Qld Water Police, Australian Federal Police, Director of Public Prosecutions (DPP)), a contracted commercial fisheries liaison officer, television ads, maps specifically for fishing operators, liaison/meetings with Qld Commercial Fishermen's Organisation and recreational groups, representatives from commercial and recreational fishermen on the Great Barrier Reef Consultative Committee, close interactions with the Qld Department of Primary Industries, Qld Fish Management Authority, member of East Coast Tuna Management Advisory Committee, Harvest Fisheries group (for collecting), and Chair and Secretariat of the Advisory Committee on Research on the Effects of Fishing in the Great Barrier Reef Region...
>
> ...The GBRMPA does not believe it is responsible for fisheries management per se but for the effects of fishing on the environment including the target resources and separating conflict between users.

*Research*

GBRMPA has a multi-disciplinary research program which is funded by the Commonwealth, the budget for 1990-91 being $1.8 million. Of this $1 million was earmarked for crown-ofthorns starfish research. Other research topics include the effects of fishing, water quality, and a Torres Strait Baseline Study (Great Barrier Reef Ministerial Council 1991). In 1991-92 funds are being boosted by $0.9 million for research into the effects of fishing and $1 million for research on the effects of nutrients.

An Advisory Committee on Research into the Effects of Fishing in the Great Barrier Reef Region has been established. It is chaired by GBRMPA and membership includes representatives of Queensland fisheries management agencies, research agencies such as the Australian Institute of Marine Science (AIMS) and CSIRO, QNPWS, and commercial and recreational fishing representatives. It co-ordinates and recommends research projects into, in particular, the effects of line fishing and trawling on the fishery and on the environment.

*Financial arrangements*

The cost of management of the Marine Park, including both the GBRMPA budget and amounts budgeted by the QNPWS for day-to-day operations, amounts to some $14 million per annum. No contribution is made to these costs by either commercial or recreational fishermen. However, the Authority is currently considering the introduction of charging systems at the direction of the Commonwealth and Queensland Governments. The Great Barrier Reef Ministerial Council has endorsed the creation of a Great Barrier Reef Marine Parks Management Fund, which would receive revenue from users of the Great Barrier Reef Marine Park (Great Barrier Reef Ministerial Council 1991).

At present the only charges in place are permit assessment fees to recover the direct costs of assessment, and monitoring fees to cover direct costs and reactive monitoring programs of larger developments.

*The commercial and recreational catch*

As indicated in the previous section, the Reef region is important for both commercial and recreational fishing.

Hundloe (1985, p. 23) suggests that Queensland would 'have the highest recreational fishing participation rate in the nation'. He cites studies published in 1978 and 1979 respectively (P.A. Consulting Services and Fisheries Division 1978, and Bandaraike and Hampton 1979) which indicate that the proportion of the population involved in recreational fishing ranged from a quarter in inland towns to one third in Rockhampton, Townsville and Cairns, 38 per cent in Brisbane and 71 per cent in the coastal city of Bowen.

The main species caught in the Barrier Reef include coral trout, sweetlip, emperor, cod, mackerel and whiting, in that order of importance. The total yearly catch by these recreational fishermen is significant.

Charter boat fishing is an important part of the recreational fishing and tourist industry in the Barrier Reef area. Boats are used for the black marlin game fishery, and for tuna, mackerel and other game or sport fishing, as well as scenic tours and pleasure boating (Hundloe 1985).

The major commercial fishery in the Region is prawn trawling. GBRMPA and the Queensland Department of Primary Industries (QDPI) have undertaken surveys and other research work to determine what the consequences of prawn trawling are for non-target species and the marine ecosystem.

There are some similarities between fisheries management arrangements in the Reef Region and those in the Torres Strait Protected Zone. Protecting the traditional way of life and livelihood of the traditional inhabitants of the area is an objective in both areas.

GBRMPA permits traditional hunting and fishing by local Aboriginal and Islander groups in most of its zones. As in the TSPZ, traditional fishing includes the catching of dugongs and turtles, both endangered species. GBRMPA has undertaken surveys of dugong numbers. Other than at Palm Island, there are no large coastal Aboriginal communities south of Cairns.

*Assessment of management*

GBRMPA has been successful in managing its fish resources on a multiple use basis. These uses include commercial fishing, recreational fishing, charter boat and tourist fishing, traditional fishing, and activities such as diving, and the provision of a refuge for fish and other organisms which might be under threat elsewhere. Zoning arrangements, including the exclusion of commercial fishing from some areas, are used in order to achieve these objectives. However, there is some question as to whether recreational fishing pressures are leading to declining catches. QFMA's proposed management controls that are discussed above aim to address these problems.

# APPENDIX H: CO-MANAGEMENT OF FISHERIES

The extent to which Australian fishermen undertake or participate in fisheries management varies widely between fisheries.

In most Commonwealth controlled fisheries industry participation in management is through a management advisory committee (MAC) that includes industry representatives as well as representatives of AFS and research bodies. Under the new management arrangements, the role of the MACs is likely to be enhanced. The role of the MACs is essentially consultative but, nevertheless, they have been, in some fisheries at least, very influential in management decisions. Since the introduction of cost recovery one of the interests of MAC members has been scrutiny of AFS budgets. The feasibility of MACs evolving into bodies with even greater responsibility for industry management needs to be considered.

## The Spencer Gulf Model

The Spencer Gulf fishery in South Australia is one of the best known examples where fishermen as a group are actively involved in management at a fishery level. All 39 fishermen in the fishery plus the 3 fishermen in the much smaller West Coast Prawn Fishery belong to the Spencer Gulf and West Coast Prawn Fishermen's Association. The association annually elects a committee that has executive powers enabling it to make decisions binding on fishermen.

The fishery is managed by a 13 person management committee comprising industry representatives and two officers of the South Australian Department of Fisheries - the fisheries manager and a biologist. All members of the association's management committee are also members of the fishery management committee. Ultimate control is still retained by Government as the fishery manager can override a committee decision and also make his own decisions. However, this power is rarely used. Furthermore, in many cases the committee needs government backing to enforce its decisions; for example, a decision to close the fishery has to be implemented through the legal powers of the Fisheries Department.

Spencer Gulf fishermen have taken the initiative on a range of management issues. They were heavily involved in the establishment of input and biological controls in the fishery. They actively participate in research programs including survey sampling and tagging. The return of research tags is encouraged through a system of rewards. Survey work is undertaken by fishermen who are paid for their labour and the hire of their boat. These costs are covered by sales from the survey catch.

When the fishery's catch declined in 1987 the industry provided $100 000 to the South Australian Department of Fisheries to enable it to transfer logbook data onto computer so that it could be used to help determine the cause of the decline. The industry is providing the boats and crew for FIRDC funded research into the state of mangroves where the juvenile prawns develop. The association also expects in the near future to be involved in seeding programs to increase recruitment.

Probably the most significant function of the association is 'real time' management. Surveys are continually taken of the size distribution of prawns in different areas. Fishing areas are then opened or closed in order to avoid catching excessive numbers of juveniles and to catch prawns at their commercially most valuable size. Such decisions can be made by the committee within 8 hours of receving an assessment by a 'committee at sea'. An imposed limited duration of the season is also important. It not only reduces pressure on the resource but also ensures that the sustainable catch is caught with less days at sea.

For safety reasons the fishery has rules requiring fishermen to cease fishing if weather conditions are severe. This is something that is unlikely to occur if it were an individual decision by fishermen, given the competitive conditions of fishing.

The association is currently assessing a scheme to rationalise fishing capacity through the transfer of net headline length. It also has a number of insurance schemes for fishermen that insure them against loss of income due to mechanical breakdowns. The association also has a scheme for buying diesel fuel through a bulk distributor. Both the insurance and fuels arrangements are organised through an open tender to ensure the best available price.

Enforcement of management decisions among members of the fishery is mainly through peer pressure which is made easier by the coordinated nature of fishing. Sometimes, however, a fishery inspector travels on one of the fishing boats to check for line infringements, where boats stray into restricted areas. The Department of Fisheries also undertakes surveillance to ensure that prawn fishermen do not target scale fish.

The activities of the association costs the members around $8-9000 per year or about $350 000 for the fishery as a whole. On top of this there is a Government licence fee of around $14 000. Industry claims that the latter cross subsidises other fisheries.

Similar arrangements exist for co-management in the South Australian abalone fishery. The Department of Fisheries in South Australia is about to establish a committee with industry representatives to explore the potential for co-management in other fisheries in that State. The committee will report by June 1992.

## The Hunter River prawn fishery

A management committee involving fishermen has recently been established in the Hunter River Prawn fishery in New South Wales. The committee comprises the fisheries manager, the senior inspector and three officers of the Hunter River Professional Fishermen's Association. The meetings are open and many of the 32 endorsement holders attend. The comittee is responsible for management measures including closures. An access fee of $200 per year is being introduced to offset some of the costs of administration, logbooks and enforcement. Other fisheries in New South Wales were not presently considered by the Fisheries Service to be amenable to this level of industry involvement in management.

## Scallop enhancement in Tasmania

Another example of industry-government co-management is the scallop enhancement program in Tasmania, which was instigated by the depletion of scallop beds in Bass Strait and Tasmania (refer to Appendix K). Initially the development of this fishery was coordinated by the Tasmanian Department of Primary Industry. The State government undertook the initial research activities and evaluation of the project. The organisational structure of the fishery management has been

determined by the phase of development: the first stage of the project requires commercial and biological evaluation and establishment of industry participation; the second stage requires commercialisation of the fishery and ancillary operations, such as marketing. The Tasmanian government indicated that the second stage required the creation of a private holding company to undertake management of the fishery and marketing arrangements. The development of such an organisational structure is assisted by the sessile nature of the scallop and the possibility of geographic delineation of the fishery.

## The scope for greater co-management

The scope for industry management and devolution of resource management will vary from one fishery to another. It is likely to be much easier to implement in 'stable' fisheries, in both biological and economic terms. It is likely to be simpler in single species fisheries, particularly prawn fisheries due to their short life cycle. For example, the form of 'real time' management undertaken in the Spencer Gulf fishery is very much determined by the short life cycle of prawns. Both industry representatives and experienced fisheries managers have claimed that the 'maturity' of fishermen and strong leadership are prerequisites.

Of Commonwealth fisheries the The Northern Prawn Fishery (NPF) is perhaps the one where current conditions are most favourable to greater co-management. In the past the industry has provided the initial impetus for various management measures subsequently adopted by AFS.

# APPENDIX I: A FRAMEWORK FOR RESOURCE SHARING

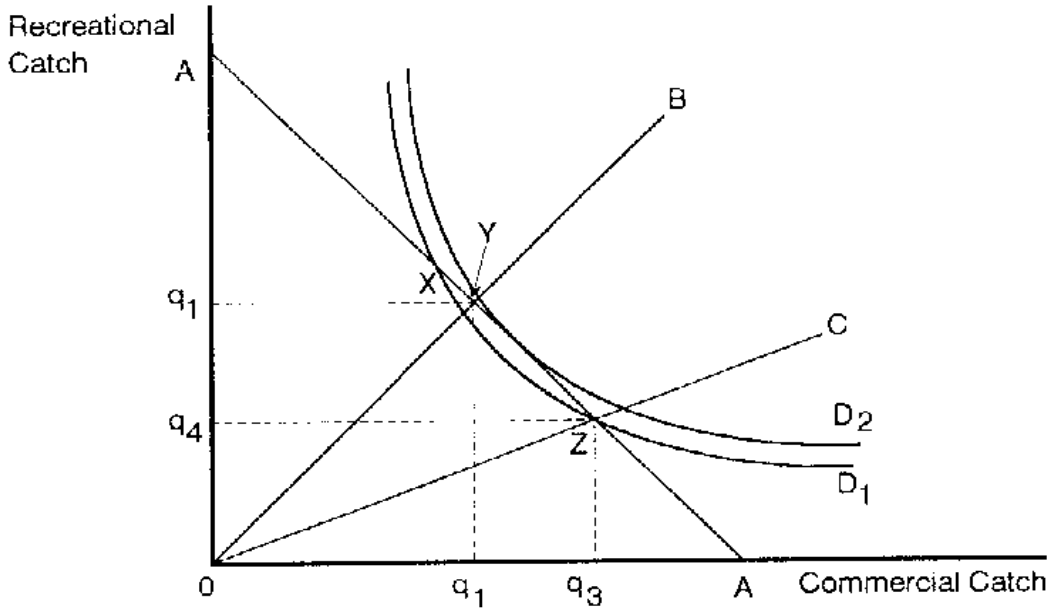
A framework for allocating use of the marine environment between competing users is illustrated below. It applies the principle that 'resource sharing' is about maximising social welfare, that is resources (fish and use of the marine environment) are allocated so that at the margin it is not possible to make one type of user better off without making another type of user worse off. The major user groups are taken to be commercial fishermen, recreational fishermen, charter boat operators, and environmental interests (such as those desiring protection of certain species for reasons of their intrinsic value or for viewing). The illustration takes two of these groups, commercial and recreation fishermen, but the principle is applicable for the broad spectrum of users.

Maximising the benefits to society requires valuing uses and allocating access to fish stocks such that the value of an extra fish caught (or more generally access to an extra fish) is the same for both groups. This approach stands in stark contrast to more simple rules often suggested for resource sharing, such as those based on the number of commercial and recreational fishermen using a fishery at a point in time or the proportion of the available catch taken at a point in time. Simple rules such as these are likely to have appeal on some notion of equity, nevertheless they are likely to result in conflict situations. One reason for this possibility is that many recreational fishermen (and, for that matter, commercial fishermen) hold the view that they have 'a God given right' to fish wherever and whenever; that is, they implicitly believe the initial allocation of a 'property right' has been assigned to them.

What the simple resource sharing rules do not take into account are changing circumstances such as demographic and attitudinal changes, and changes in consumer preferences and costs of fishing. Two examples of change are population growth and demographic shifts to coastal locations, both of which have led and are likely to continue to led, to increased numbers of recreational fishermen. Another noticeable change is the increasing demand by seafood consumers for product which, all other things held constant, would increase the value of commercially caught fish.

The framework presented below puts aside the very important issue of stock-fishing effort dynamics (as discussed in Appendix J). It assumes that a total allowable catch has been established on sound scientific grounds, that species interdependancies are known (or not a consideration), and that fishing effort can be accurately measured for both groups of fishermen. The model also assumes there is direct competition for the same fish in the fishery, and it assumes that there is no over-capitalisation in the commercial fishery.

Figure I.1: **Allocation of Fish Stocks Between Commercial and Recreational Fishing**




In Figure I.1, the vertical axis represents the recreational catch and the horizontal axis the commercial catch, for a given period (say annually). The line AA represents the TAC, that is, possible combinations of catches by the two sectors. For example, if only commercial fishing was allowed, the commercial catch would be OA fish and the recreational catch zero; alternatively, if commercial fishing was prohibited, the recreational catch would be OA fish and the commercial catch zero.

The line OB shows equal shares of the catch to both sectors, with Oq1 fish being caught by both (Y is the mid-point on line AA). Any other combination of shares is possible by moving along line AA. Line OC shows two-thirds of the catch going to the commercial sector. It is not possible for the total catch to be to the right of AA. It is possible for the total catch to be to the left of AA, but that would be less than optimal use of the fishery.

To determine whether an equal share arrangement is better or worse than some other sharing arrangement it is necessary to measure the net benefits of both types of fishing, and then to determine at what point on the line AA an extra fish caught by the recreational sector is equal in value to an extra fish caught by the commercial sector.

The net value of fish caught by the commercial sector is the sum of consumer surplus (net benefits to consumers of purchasing commercial caught fish) and producer surplus (which can be thought of as profits to commercial fishermen and to any other associated sectors). Such benefits can be calculated from demand and supply schedules based on market data.

It is not possible to use market information to calculate the net benefits of recreational fishing because the right to go fishing is not a market-oriented recreational activity as, for example, movie going is. There is, therefore, the necessity to base calculations on surrogate markets (as with the travel cost method) or willingness-to-pay surveys. (Studies of this kind have been undertaken for some Australian fisheries). What needs to be recognised is that it is not what recreational fishermen pay in the way of boat fuel, bait, etc which determines the net value of recreational fishing, rather it is the consumer surplus (which is derived from a demand schedule showing what they actually pay, which could be zero, and what they are willing to pay). Just as it is incorrect to value the net benefits of commercial fishing in terms of the costs of a fishing trip so it is incorrect to value the net benefits of a recreational fishing trip in terms of the expenditure for a trip.

Once the net benefits of fishing by both sectors have been calculated it is possible to derive an aggregate net benefit function that would result from the catch of various quantities by both groups. The aggregate net benefit curves are called 'iso-value' curves since the aggregate net benefits are equal for all sharing allocations on a particular curve. In reality there would be any number of these, but to illustrate the principle only two are shown in Figure I. The further out from the origin an iso-value curve is, the greater the aggregate net value from fishing. One such curve is $D_1$ in

Figure I.1. This is drawn on the basis that presently the catch is shared so that commercial fishermen obtain two-thirds of the total, $Oq_3$, and recreational fishermen one-third, $Oq_4$. Because the iso-value curve goes through point Z on the line AA (the total allowable catch line) all the available catch is taken.

Iso-value curve $D_2$ (in Figure I.1) also meets AA, in fact it is tangential to it. It is further from the origin then $D_1$ and hence produces greater total net value from fishing.

What this simple illustration shows is that if the shares were altered (from $q_3$, $q_4$ to $q_{31}$,$q_1$), there would be an overall gain. This means reallocating some fish from commercial fishermen to recreational fishermen. Society would be better off even though the commercial catch has been reduced by the quantity $Oq_3$-$Oq_1$. This is a hypothetical example and others could be shown to illustrate a societal gain by reducing the recreational share and increasing the commercial share. Such would be the case if the original sharing arrangement was at point X on AA (where recreational fishermen had the greater initial proportion).

It is not possible to make society better off by moving to a higher iso-value curve than $D_2$, as it would require a total catch greater than the available catch. If the TAC increased in the future, societal gains would also increase by moving to a new iso-value curve further from the origin.

The highest possible societal value at any point in time is obtained when the iso-value curve is tangential to the total allowable catch curve. The slope of the iso-value curve shows the rate at which recreationally caught fish should be 'traded' for commercially caught fish, while retaining the same overall benefits to society. Reallocation of shares should continue until the marginal net benefits (the value of an extra fish) to both recreational and commercial fishermen are equal.

The principle sketched above could also be applied to allocate access to the marine environment where there is direct competition between fishing (of both kinds) and fish/marine-life viewing areas such as dive or snorkelling sites. With suitable modification it could also be applied to situations where there is direct conflict between fishing and changes to nursery/breeding grounds.

# APPENDIX J: FISHERIES BIO-ECONOMICS AND THE OPTIMAL ALLOCATION OF RESOURCES

## Fish as Renewable Natural Resources

Fisheries management is about the wise use of natural resources. The concept of wise use of natural resources is covered in an extensive literature and does not warrant significant attention in its own right here, other than sketch its fundamentals, which can be done by reference to the early work by fisheries economists.

Crutchfield and Pontecorvo (1969, p 3-4) provide that sketch, thus:

> In the broadest meaning of the term, wise use of natural resources implies evaluation of their present worth in a dynamic setting of general equilibrium. In this sense, of course, proper use of natural resources can hardly be separated from the allocation problem as a whole. Given assumptions as to rates of economic growth, patterns of demand, costs, and relative prices of substitute and complementary products, conservation of any natural resource clearly is an aspect of capital theory, involving optimal time rates of use of the assets involved and optimal factor combinations at each use rate.

In terms of a fishery Frost and Johnston (1985, p 62) state the concept simply, thus:

> A fish not harvested today - an investment decision - represents foregone current consumption (costs), to be weighed against the expected future return on this investment (benefits). Alternatively, the cost of harvesting for current consumption includes the foregone opportunity to consume larger and more abundant fish in the future, as well as the value of the goods and services which could have been produced by the resources (effort) used in current harvest.

This is 'wise use' as defined in economic terms. It is 'conservation' determined by the market. The future expected costs and benefits are determined by the present generation. As the economic literature points out, extinction is not incompatible with such a notion of wise use - here there is tension between a market-determined solution and sustainable development.

As a general principle property rights are not attached to areas of the marine environment. Property rights are attached to fish and other marine products on capture. The 'right' to capture is a privilege bestowed on fishermen by society. It is probably inevitable that unregulated common property resources will be over-used: the natural resource will be over-exploited and there will be over-commitment of physical and human resources. In the simplest terms, each commercial fisherman will have an incentive to harvest as much of the available catch as quickly as possible. What he does not take, a competing fisherman will. All fishermen will 'play the same game'. Market failure is the result.

The history of ideas in fisheries management has gone through two distinct phases. Prior to the early 1950s, the management theory and practice was based on a biological goal of maximising the sustainable yield (MSY)[1]. From that time a separate fisheries economics literature commenced to develop, and the concept of maximum economic yield (MEY) was put in opposition to MSY. As Cunningham (1981, p 251) states: 'From the early 1950s to the early 1970s, these two concepts competed with each other for the place as fundamental objectives of management'.

Some would suggest that there was, or is, a third phase, that based on optimum sustainable yield (OSY). The OSY concept is often termed 'optimum yield' or 'maximum social yield' (Anderson, 1977, p 124). This concept is difficult to define, but is usually, though not universally, taken to include biological, economic, financial, cultural, social, legal and political factors. Such a broad definition, involving multiple trade-offs between conflicting objectives, provides no practical guide to management. Yet, OSY is an extremely important concept in the sense that fisheries administrators are forced to take into account all these factors; and to better comprehend the types of management decisions actually made the influence of these factors has to be recognised.

[1] The MSY concept is based on the notion than an unexploited fish population will reach an equilibrium level of biomass, reaching this level at various rates depending upon its initial size in weight. Numerous environmental factors determine this natural equilibrium size, for example, the environmental 'health' of breeding and nursery grounds, salinity, temperature, etc. With no changes in environmental parameters, there are three elements in the growth rate of an unexploited stock: (i) recruitment, (ii) individual growth, and (iii) natural mortality. Fishing by man introduces another predator into the system. Depending upon the fishing effort man applies, different equilibria population sizes will occur.

While the dispute as to the relevance of MSY, MEY (both static and dynamic) and OSY is at the heart of theoretical fisheries management, this is not of prime concern here. What is important is an understanding of MEY. There is very important distinctions between static MEY and dynamic MEY. Static MEY fails to take into account time (alternatively stated, it corresponds to using a zero discount rate to evaluate the present value of a fishery) and this is important for fish which grow over time. The correct economic procedure is not to maximise net benefits at any point in time but to maximise the discounted present value of future net benefits. Dynamic MEY is determined by the price of fish, the costs of harvesting and the rate of discount used. As Cunningham (1981, p 269) points out, information on prices and costs would be required until infinity, though discounting reduces the time span to about 30 years. Crutchfield (quoted in Cunningham, 1981, p 270) states that dynamic MEY assumes a 'level of information on a forecast basis which is not only unavailable at present, but almost certainly will be unavailable at any conceivable cost in the future'.

The concept of MEY is open to interpretation and is used differently in the literature. There has been a tendency (in applied work) to equate it with maximum economic rent and not include surpluses which can be maximised. If there are no consumers' surplus or producers' surplus to be gained from altering the management of a fishery, which would be the case if there are no intramarginal inputs of capital and labour (quasi-rent) and if demand for fish was perfectly elastic, then MEY *could* be seen as maximising the totality of economic benefits.

## The Simple Bio-Economic Model

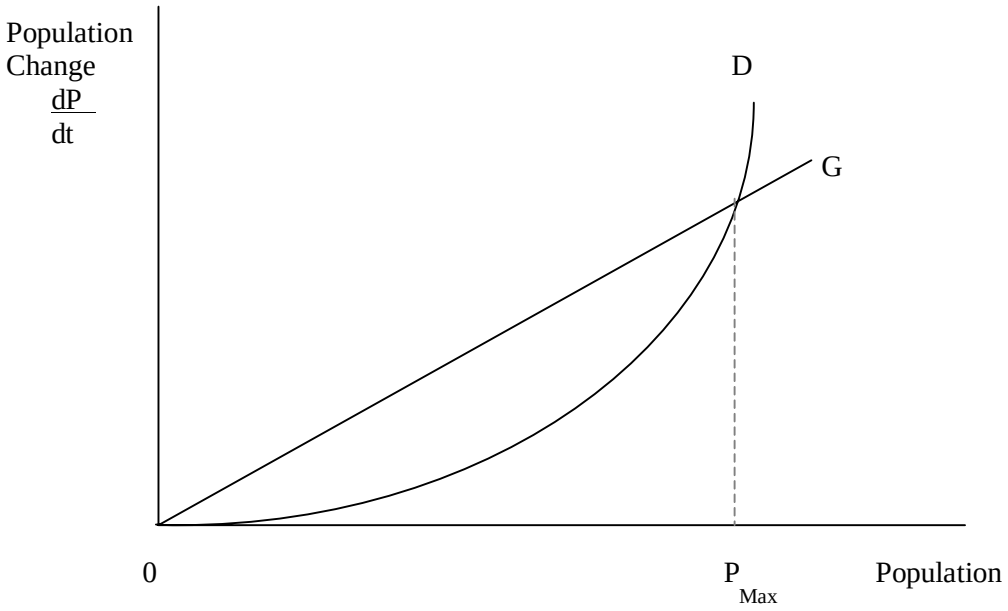
The economic implications of open access to a common property resource are discussed next, but the main point for present purposes is the integration of biological models and economic analyses. It is recognised that the models presented here are simplistic and do not necessarily reflect advances in fisheries biology, and the assumptions in the economic models do not necessarily represent the real world.

The theoretical analysis is conventionally based on a so-called Schaefer-type yield curve. This curve is bell-shaped and shows the relationship between catch and effort over time. It suggests that a fish stock will reach an equilibrium population level for a given level of effort. The costs and earnings of fishing determine an equilibrium level of effort, and that level will be where total revenue equals total costs for the fishery. That level of effort will not be one at which greatest 'profits' are earned for the fishery as a whole. The largest possible profit is obtained where the difference between total revenue and total cost is the greatest. This level of effort, which produces the maximum economic yield (MEY) will not correspond (except in certain circumstances) to the maximum sustainable yield (MSY). The latter, by definition, is at the peak of the yield curve: the yield curve can be constructed as the total revenue curve if the price of produce is constant, that is total revenue varies directly with catch. The MEY is reached before MSY is reached, if the discount rate is zero. If the discount rate is not zero, MEY may be greater than, equal to, or less than MSY. MEY can be defined narrowly here, that is, viewed in terms of maximising the rent from the resource and neglecting factor rent, consumer surplus and 'psychic income' to fishermen.

The brief discussion can be expanded as follows. Fish, like other natural, renewable resources, are capable of yielding a sustained yield indefinitely. The basic theoretical proposition is that the rate of their renewal depends directly on the resource left unharvested, and the rate of growth of a population can be considered to be directly proportional to the stock of that population. The theoretical analysis is usually framed in terms of growth being a function of a fish stock's size in weight, or biomass. To simplify the discussion here 'population' can be used as the independent variable. The rate of growth of a population is therefore a straight-line function. This is the simplest model of the population dynamics of a fish stock. Certain assumptions are built into the model: the population is a single unit; both short term and long term fluctuations in the stock are insignificant; environmental changes have no effect; and, the biomass is a single mass independent of age structure. In many fisheries some, or all, of these assumptions do not hold.

The straight line of growth function is illustrated as curve OG in Figure J.1.

Figure J.1: **Growth Function**

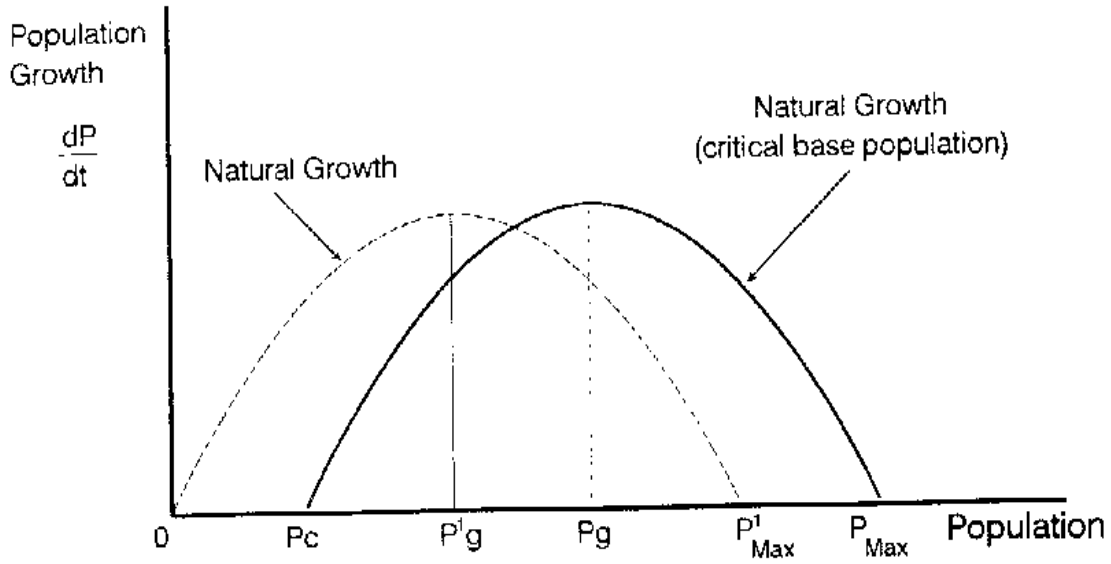



If deaths did not occur, the population would expand exponentially. Natural mortality, as a result of predation, age, disease, limited availability of food, means there is a maximum population for a fish stock. In the graph this is represented by population level $P_{Max}$. The curve OD represent natural deaths. At low populations there is low natural mortality, but as population increases mortality increases at an increasing rate. Various factors, such as food limitations, mean that as the maximum population is approached the rate of mortality increases.

The natural rate of growth of a population is the difference between curves OG and OD. This is illustrated in Figure J.2.

Two natural growth rate curves are shown. The dotted line represents the situation where there is no critical base level of population (which is the standard graphical presentation), while the full line represents the situation where there is some minimal level of population below which populations cannot be maintained, and this would seem to be the more realistic situation for some forms of life.

Figure J.2: **Natural Growth**




Both curves ($^{OP1}_{Max}$ or $^{PcP}_{Max}$) illustrate the same relationships between population levels and growth rates. The growth curve shows that a sustained yield can be achieved for any population level - if the rate of harvest does not exceed the rate of change in the population. From this the concept of a sustainable yield is defined, being the maximum quantity that can be harvested from a given population without decreasing its level in the next period.

The population increases from zero (either O or Pc) and growth reaches a maximum at the top of the curves, at population levels of $P^1g$ or Pg. Beyond the level of population at which growth is a maximum, the rate of growth decreases as population increases. The explanation for this phenomenon is: at low population levels there are few fish with abundant food and population can increase rapidly; as population levels become higher, the available food has to be shared among more members of the population and the population declines. Finally food, and other factors, bring a complete halt to population growth.

Without fishermen acting as an other predator, the equilibrium level of the population will be $^{P}Max$ (or $P^1Max$). If for some reason population temporarily exceeds $^{P}Max$ ($^{or\ P1}Max$), it will be eventually forced back to this position by natural constraints.

For an actual fish stock, the rate of growth at any level of population could be expected to vary over some range and the growth curve/s should be considered as the average. Likewise, the natural equilibrium population level will be a range. The extent of variability is obviously a very important consideration in applied analyses.

The standard Schaefer yield curve as illustrated in Figure J.2 represents a compensatory growth function. Such a growth function indicates that it is virtually impossible to totally fish a stock out. This is because, as the stock declines, the growth rate increases (due to, for example, increased amounts of food and space per fish), and even if there are only two fish left, the Schaefer curve says that stocks will recover if fishing effort is reduced.

However, a more realistic growth function will have a range, usually associated with lower stock levels, whereby the growth rate falls as stocks decline. This is representative of the fact that the fish may find it harder to find each other to reproduce, and if it is a schooling fishery, the predation rate may increase. In this case, if stocks are fished down their recovery rate becomes much slower, and sustained fishing effort may lead to severe depletion, and the productivity of the stock, at these stock levels, is usually very low.

If a fishery is fished down to the stage whereby the growth function exhibits depensation then it is defined as being depleted. Once a stock becomes depleted the associated fishery will collapse unless there is a substantial proportion of capital within the fishery which can be easily diverted to other uses or fisheries.

If stocks are pushed below a critical level then, again depending on the shape of the stock's growth function, it may be that negative growth of the stock will occur, even if there is no fishing. This will be the case, if, for the lowest range of stock levels, there is critical depensation (see Figure J.3). This may occur, for example, if the reduced rate of recruitment and the increased rate of natural predation cause a net decline in stock numbers. When there is critical depensation there is both an increasing rate of reduction in the fish stock and negative levels of growth of the stock. In other words extinction is predicted.

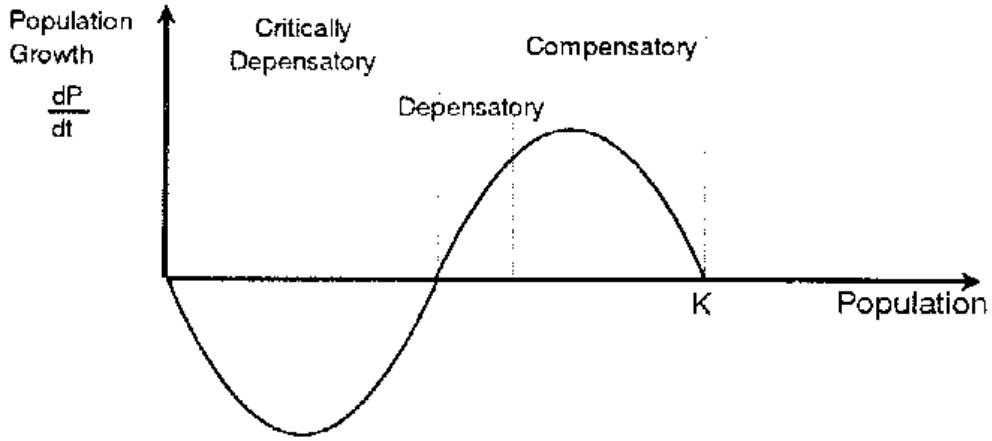
The shape of the growth function is most critical when:

- there is a schooling fishery, as the costs of fishing do not increase as rapidly, compared with widely dispersed populations, as stocks decline, possibly making it economic to fish stocks down to the ranges where depensation cuts in;

- under open access, or if open access is overshot, again the associated decline in stocks may mean that the stock level moves outside the compensatory range; and

- the stocks are long lived. This implies that the growth rate is slow, hence increasing the recovery time needed after overfishing; and, also decreases the incentive to invest in the stock, hence, once again, increasing the likelihood that stocks will be fished down to the level where growth becomes depensatory.

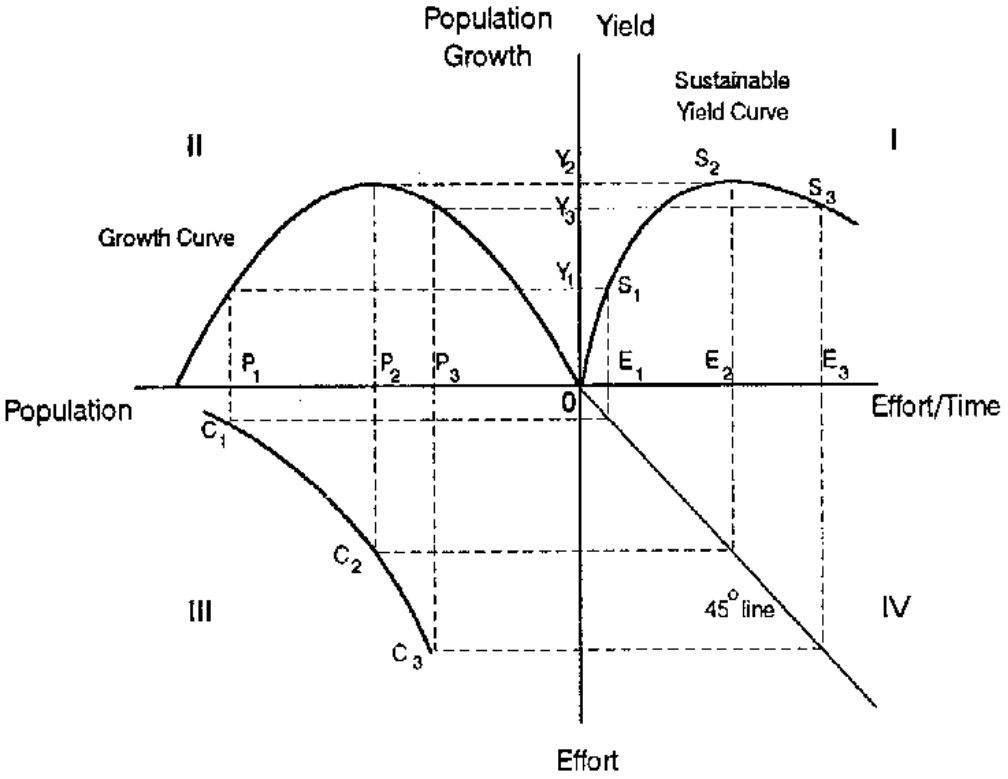
Figure J.3: **Critically depensatory, depensatory and compensatory growth**




Implicit in the natural growth curve depicted in Figure J.2 is the notion that it is possible to harvest a fish resource, in each period, to such an extent that - subject to natural fluctuations - a constant population level is maintained. A sustained yield curve can be constructed from information on the level of population and the level of effort. This is done as follows (the construction here is based on Waugh, 1984, p 37-40; Anderson, 1977, p 79-80 uses a marginally different construction). The construction uses four quadrants, see Figure J.4. Quadrant II shows the relationship between

growth rate and population level: increases in population are measured leftward. Quadrat III shows the relationship between the effort (which is only realistically measured as the cost of fishing) and the level of population. If effort is low, at say C1, the population level is high, at P1. With an increase of effort say to C2, the population level falls from P1 to P2. Quadrat IV has a line at 45ø, to allow effort to be shown on both axes. In quadrat I the sustainable yield curve is derived.

Figure J.4: **Sustained Yield**

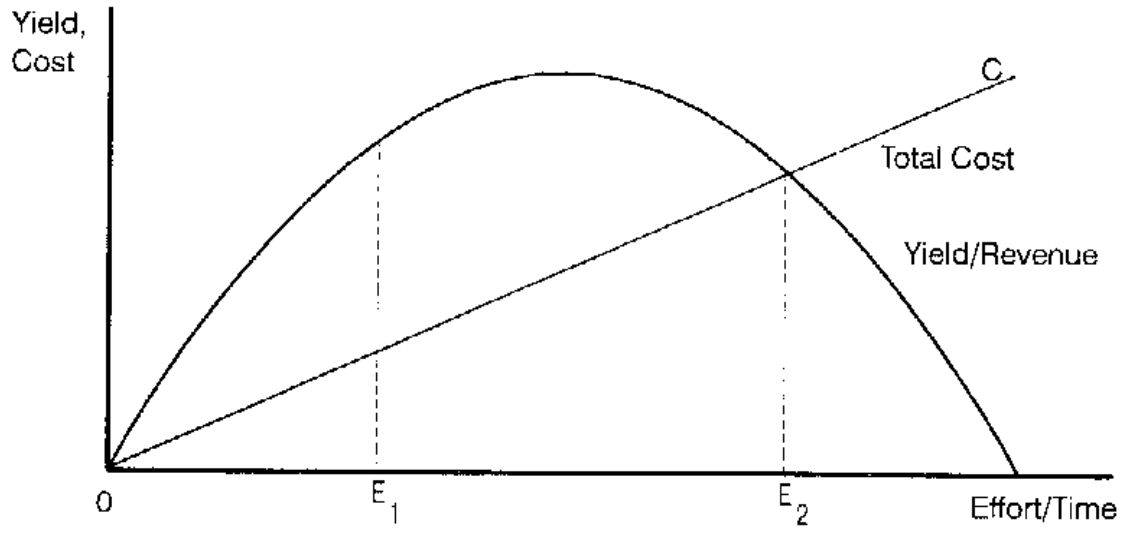



When effort is low, at E1 (=$C_1$), the population is harvested at a low level and therefore the population is relatively high at $P_1$. At this relatively high level of population the rate of change in the population is low, at $Y_1$, and the equivalent sustainable yield is low at $S_1$. Moving to higher levels of harvesting, at first the rate of change of population rises and then falls. At $C_2$, the population is reduced to $P_2$, and the rate of change in the population increases, to $Y_2$, and sustainable yield increases to $S_2$. At even higher levels of effort, $C_3$, population decreases to $P_3$, the change in population drops to $Y_3$, and sustainable yield is $S_3$. This is the model: based on a chain of causality within the model, if not within the natural ecosystem itself, as Waugh (1984, p 37) points out.

The sustainable yield curve is so called because a sustainable population will not be affected by fishing, since catch is replaced by natural increase. It follows that the same level of effort will yield the same quantity of catch in the next period. The model presented above is constructed on the law of variable proportions. That is, there are diminishing returns to effort, as more effort is applied there is increasingly smaller returns per unit of effort for a given level of population; and there is a population effect, as population decreases more time is spent in searching and fishing so that the yield per unit of effort declines (see Waugh, 1984, p 37-43).

The next step in developing a model of an exploited fish population is to bring yield and the cost of effort together. The level of population depends on the quantity harvested, and quantity of the harvest depends on the level of effort and the level of effort determines the level of costs. This is shown in Figure J.5. The cost curve, OC, showing total costs associated with each level of effort, is superimposed on the sustainable yield curve. This yield curve can be viewed as the revenue curve on the assumption that the price of fish is constant. The straight line cost curve is based on the assumption that the effort units come at the same cost (for example, each boat entering a fishery can be added at the same cost). It is extremely important to note that both curves are long run phenomena. At $E_1$, there is a maximum difference between total cost and total revenue. At $E_2$ both are equal.

Figure J.5: **Yield and effort**

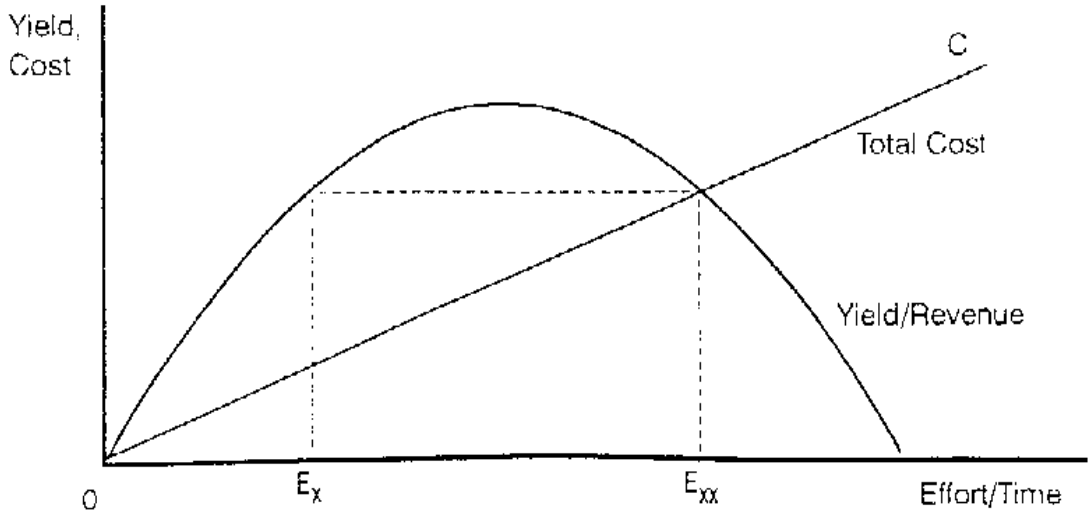


This type of bio-economic analysis forms the basis of managing fisheries to meet the dual objectives of biological sustainability of fisheries resources and economic efficiency in the exploitation of the resources. These objectives can be mutually reinforcing. Nevertheless, there can be tension between the short term financial objectives of those presently fishing and the long term objectives (including the profitability of future fishermen). Present fishermen may have a discount rate high enough to push the economic yield (MEY) beyond the maximum sustainable yield (MSY).

## The Measurement of Management Rent

The level of effort $E_2$ in Figure J.4 is the open access equilibrium; that is, without management the number of boats (using boats as a simple measure of effort) in the fishery will have increased until the cost and earnings for the fishery are equal, this being a break-even situation for the fishery as a whole. What can be shown is that a much smaller number of boats (and hence far less expenditure on effort) can take the same value of product. This is illustrated in Figure J.6.

Figure J.6: **Management Rent**



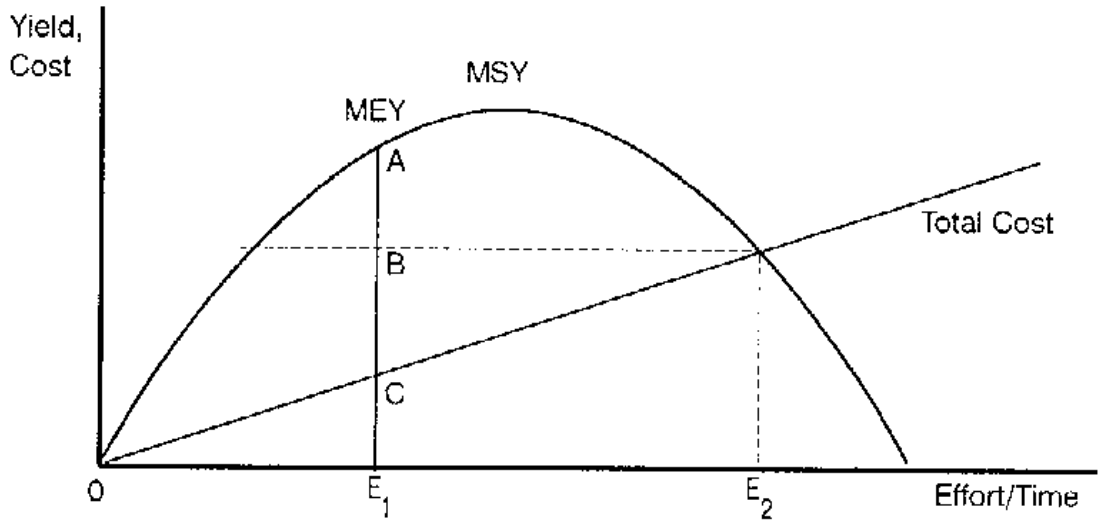
What is shown is that the same quantity of fish (and, in this simple model, same total value of catch) can be taken by either $E_{xx}$ or $E_x$ levels of effort. If policies are implemented to reduce the number of boats (and other resources) to the $E_x$ level, society is better off, simply because less resources are used to generate the same amount of revenue from fish sales. It is not necessarily as simple as this.

In the first instance, the costs of management incurred to achieve this result - and to maintain this outcome through time - have to be included as costs to the fishery. That does not imply anything about who in society should meet these costs. In the second instance, if resources (boats, labour, etc) are withdrawn from the fishery, a gain will only result if they can be used productively elsewhere in the economy. If there are no alternative uses for the boats (in other fisheries or for other purposes) or if skippers and crew cannot find other employment, the economic calculations have to be altered. By that it is meant that a new cost curve has to be constructed which measures the costs of boats and labour at their low or zero opportunity cost. The lack of alternative uses of boats is one very important, and valid, reason in explaining the slow process in restructuring an over-capitalised fishery. If the opportunity costs of the boats is zero, it is rational for fishermen to continue as fishermen as long as they cover their variable costs. This emphasises the importance of time in achieving restructuring of a fishery. What the simple models depicted in Figures J.5 and J.6 do is show two 'snapshots' of the fishery, before and after restructuring. They are comparative static analyses. This issue is discussed further later. Before doing that it is informative to consider a somewhat more complicated aspect of the bio-economic model.

By taking into account the bio-economic relationships described in Figure J.4, what can be illustrated is two distinct gains from reducing effort from the open-access to the MEY level. Figure J.7 is drawn to show this. (This follows Campbell's 1991 construction.)

As a consequence of the relationship between effort, population and yield, the reduction of effort from $E_2$ to $E_1$, produces results in a yield effect, shown as an increase in the value of total harvest BA. It also produces a reduction in total cost, shown as BC.

Figure J.7: **Gains from Effort Reduction**




This analysis is relevant for fisheries presently being exploited at level beyond MSY and for which a reduction in effort will eventually mean an increase in population and hence in yields. This is not necessarily the case for short-lived species such as prawns where this relationship between effort, population and yield does not hold.

## Restructuring and Time

The first question posed by an analysis such as that shown in Figure J.7 is how long will it take after a reduction of effort to build the population up to the optimal level. This depends on both the natural growth characteristics of the species in question and the amount of effort the stock is subject to during the adjustment process. This highlights the need for a good scientific understanding of stock dynamics. It also requires an understanding of economic factors. As Campbell (1991, p. 154) argues:

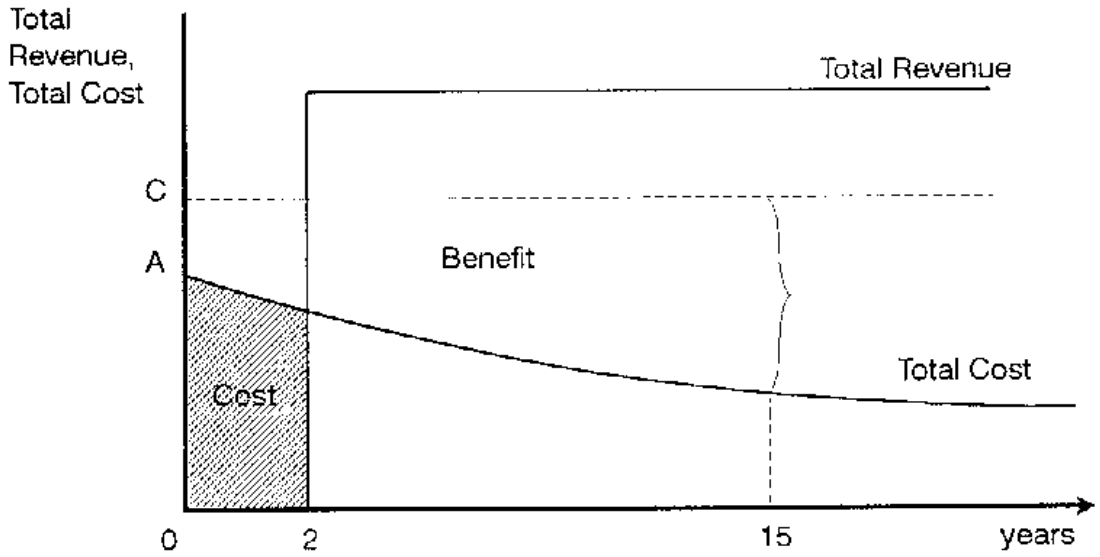
> The length of time needed to shift excess fishing effort to productive uses elsewhere depends on the opportunities which exist. On the one hand, if the vessels, gear and crew can be transferred to an under-exploited fishery little time is involved. However many existing fisheries are already over-exploited and the phenomenon of vessels pushed out of one fishery by regulation turning up and causing problems in another is a familiar one. If there is no alternative use for the vessels then the transfer of resources takes place gradually over time: there is an immediate saving to the economy of variable inputs, such as fuel; labour is released from the industry and is available for employment; and resources are directed from maintenance, repair and replacement of vessels. The amount of time required for the complete process to take place may be several years.

In the case of no alternative use of boats (the opportunity cost is zero - the capital is sunk) fishermen will continue fishing while they can cover variable costs and earn a fraction more. As boats depreciate and approach the end of their economic life fishermen should exit the fishery voluntarily. It is more complex than this in reality and there are significant differences depending upon the institutional framework. An ITQ-managed fishery will restructure itself as suggested above in quote from Campbell. For an input-controlled fishery this is not likely to be the case. The investment in a boat might not be the only major cost a fisherman has made to enter a fishery. A fisherman could have purchased an entitlement which cost substantially more than the boat; he might have an entitlement which allows him to re-enter the fishery and as soon as his perception is that enough boats have exited to allow him to re-enter and make a normal return he will do so. It is also likely that collectively fishermen will put pressure on governments to address the problem by, for example, implementing a buy-back scheme, and depending on his expectations as to the future an individual fisherman could engage in strategic behaviour.

What this suggests is that both institutional factors and the behavioural characteristics of fishermen (either individually or collectively) work against autonomous adjustment in a fishery. There is evidence of fishermen being presented with sound economic analyses which show the benefits of effort reduction which could be achieved by a voluntary, industry-funded buy-back, yet this does not generally occur. There is also evidence that 'natural' restructuring does not happen. The Northern Prawn fishery is a good example of this phenomenon in a long-established fishery. There were the same number of boats in the Declared Management Zone of the Northern Prawn fishery in 1982 as there were boats fishing in the (then larger) Northern Prawn fishery in 1971. Cost and earnings studies prepared for that fishery for the years 1974-75 to 1977-78, 1980-81 and 1981-82 showed that negative rates of return were more common then positive rates of return for the six years investigated, yet investment in new and more costly vessels continued throughout the period, not a natural restructuring as one might have expected. The situation of over-capitalisation continued for the following 10 years, and is presently being addressed by a buy-back scheme, partly funded by taxpayers.

Campbell (1991) has illustrated the time-path involved in moving from an open-access situation to an MEY level of effort. His hypothetical case is one in which a two year moratorium on fishing is imposed, there are no alternative uses for fishing boats during that period, but over a 15 year period excess boats exit the fishery at a constant rate (to go to other uses). Fifteen years is taken to be half the economic life of a well maintained boat. Figure J.8 illustrates the situation.

Figure J.8: **Time-path of Fishery Rent Generation**




The open-access, pre-management levels of total revenue and total cost are the same, and shown as OC. During the two year moratorium, variable inputs (Campbell uses fuel as an example) are immediately shifted to other uses and a cost saving of CA results. While this saving to fishermen occurs, there is a loss over the two year period due to the fact that the boars are tied-up. This is shown by the shaded area identified as 'Cost' in Figure J.8. With the re-opening of the fishery after year 2 it is assumed that total revenue has increased from the pre-management situation, because

higher catches are now made. This is shown by the full-line titled 'Total Revenue'. Because there is a gradual reduction of effort, total costs continue to fall as shown by the Total Cost curve. Throughout the period there are increasing benefits generated. It is not until year 15 that the benefit (management rent) shown in Figure J.7 (at effort level $E_1$) is fully realised. There are other possible strategies, such as a phased reduction of effort rather than a moratorium, which should ultimately produce the same result, but the total revenue and total cost curves would be of different shape.

Discounting has not been applied to the benefit and cost streams in Figure J.8. What is required is the present value of the net benefits. Net benefit means that the costs to the management authority of bringing about the restructuring have to be added to the fishing industry costs. The cost and benefit streams have to be converted to present day dollars.

Campbell (1991, p. 155) quite correctly argues that the history of a fishery is a very significant factor in determining the magnitude of net benefits from restructuring:

> if the fishery can be subjected to management before stocks are run down and large amounts of capital are committed to it then it can make a valuable net contribution to the economy; if, on the other hand, it is subject to open-access exploitation then the situation may become irretrievable in the sense that no contribution the fishery could make in the future justifies the current cost of investment in the fish stock.

It is an empirical question as to whether or not the net benefits in a particular fishery are large enough to justify the management costs involved in restructuring. Amongst other things, this raises the important question of what actions, and their associated costs, are involved in bringing about the desired result.

## The Costs to Management of Restructuring

The management actions required to engender restructuring should be differentiated from those which are necessary regardless of the state of the fishery. It could be argued that an open-access fishery with no concerns pertaining to biological matters requires no management other than, say, surveillance and enforcement to prevent foreign encroachment. A limited entry fishery, where (as is usually the case) limited entry is imposed at the open-access, break-even equilibrium level and

no attempt is made to reduce effort, requires some additional management; for example, to ensure no encroachment by Australian fishermen not permitted to enter it. In such a fishery there would probably be biological controls applied for either, or both, biological or economic reasons, and these have to be enforced. A fishery managed by a competitive global quota requires management to ensure the quota is not exceeded. The list could be readily extended.

For a variety of reasons, government-funded research is likely to be undertaken in fisheries, whatever the state of the fishery. The goals of this research will determine whether or not it is related to management, and if they are this is an additional cost of management.

There are a variety of actions by management authorities, such as administering a licensing system of boats and skippers, of product quality control, etc. which are not related to the state of the fishery.

What actions, and what costs, are involved in restructuring per se depend on the approach applied. For an ITQ-managed fishery the major management cost of restructuring is likely to be that associated with research to calculate the TAC. That can be an expensive exercise. It is likely that research will have to continue for some time after the initial assessment, given the inherent uncertainties in setting sustainable TACs. On the basis of improved knowledge there is always the probability of imposing a revised TAC. The other management costs involved in introducing an ITQ-managed system are administrative (for example, allocation and recording of individual quotas), and there will be a need to spend time and effort in explaining the system to fishermen. The resources (and expenditure) involved in obtaining agreement from fishermen should not be under-estimated. The difficulties and costs will be exacerbated if there is a need to share the resource between commercial and recreational fishermen. Once these tasks are completed, there are no further costs to the management agency in implementing restructuring. The market for ITQs facilitates restructuring. It is this characteristic of restructuring which makes ITQ management appealing to managers.

Restructuring an input-controlled fishery involves a different set of management actions and costs, although there are likely to be similar requirements for research and administration (pertaining to

the operations of a licensing system). Notwithstanding the fact that a TAC does not have to be set (at least explicitly), there is the necessity to understand what the sustainable catch is so that the input controls can be designed to achieve this goal. Such action is, of course, necessary even if an input-controlled fishery is going to be let operate with excess capacity.

One obvious additional management requirement which is a precursor to restructuring an input-controlled fishery is undertaking bio-economic research to determine the MEY level of effort. Regardless of the mechanism which is used to reduce effort the managers need to know what level of effort is optimal. There are various mechanisms, including a tax on inputs or landings so that the private costs to individual fishermen are made equal to the social costs to all fishermen[2]; a buy-back of excess effort; cancelling of entitlements; a boat/gear replacement policy which has the effect of reducing effort; non-transferability of entitlements[3]; or a combination of all or some of these. Assuming the bio-economic analysis is done (there are numerous examples of such analysis undertaken over the past two decades), there is the need to continually revise the analysis, even if the biology is well understood in the first instance. The problem is the economic aspect. In the first instance, the MEY level of effort is not necessarily constant over time, as prices of the product and the inputs are likely to change. To use a landings tax as an example of the restructuring mechanism, there would be a requirement to change the tax as these variables altered. In the second instance, it has proven impossible in practical terms to control all inputs for any period of time, and as a consequence of fishermen adopting technological changes, working longer, etc. excess effort will occur again.

Restructuring of an input-controlled fishery is an on-going process. It requires continually (or at least periodic) monitoring of the economic health of the fishery. There is the cost of administering the restructuring scheme; for example, if a landing tax is used, there is the on-going collection of the tax; if other mechanisms are used, there is the cost of ensuring compliance. Before a scheme is put in place there is the need to design it, explain it to fishermen and gain acceptance from them, although these aspects are not necessarily more costly then putting in place an ITQ system, primarily because fishermen are familiar with certain aspects of input-controlled management.

2 A tax on landings/royalty approach to restructuring is not dependent on there being a limited entry regime in place. The approach does not imply any form of property right. It does nothing more than change the financial incentives to fish.

3 If entitlements were non-transferable, they could be retracted at the time a fishermen retires, and this would continue until the optimal number of entitlements is reached. At that time entitlements could be made transferable. This has obvious equity implications.

In assessing the costs to the management agency of restructuring in an input-controlled fishery one needs to know what mechanism/s is/are to be used. For reasons to do with acceptance, as well as economic or institutional factors, some mechanisms, if used by themselves, would be ruled out. There are economic and practical reasons to suggest that restructuring cannot be achieved by a tax which equates private and fishery-whole costs. In the case of severe excess capacity the tax would have to be so high that all fishermen are likely to incur losses. Furthermore, there is no familiarity with the use of taxes for this purpose, and hence the concept would not be understood and would not be supported politically. Cancelling of entitlements is ruled out on institutional grounds. Non-transferability of entitlements would not find favour with many fishermen. The manager is left with imposing a buy-back scheme (on the assumption that fishermen find it impossible to make a collective decision to manage their own buy-back) and some combination of the other mechanisms.

This raises the question as to whether or not a buy-back scheme (whether voluntary or imposed) can pay for itself just as an ITQ-based restructuring pays for itself by willing buyers and sellers agreeing on a price to trade. In theory both approaches should not differ in this regard. In either type of management regime, if there are no alternative uses of boats/gear, exit would occur gradually unless those wishing to remain in the fishery were willing to pay a price high enough to compensate those leaving for both entitlements and capital invested. In practice there are complications resulting from strategic behaviour of fishermen (those who hold out the longest are likely to obtain the greatest benefit) and the capitalisation of expected increased profits. These also can be factors with ITQs.

Anderson (1977, pp.180-181) discusses these issues and adds comment on government-funded buy-back:

> Rational licensees, able to capture some of the wealth of the fishery in the form of payment for their licenses, will not sell unless the purchase price approximates the discounted value of the stream of net income they could earn by continued fishing. This measure will go up as more fishermen sell out, so those who hold out longest will obtain the most benefits.

The money to buy back the licenses would presumably come from general government funds, in which case fishermen, especially the hold-outs, will be subsidized by the rest of the economy. The fishermen who remain will be benefited in two ways: the net value of their catches will improve as total effort is reduced while at the same time the value of their licenses is increasing. This may offer some justification for taxing them to raise money for the buy-back program. Increased returns from the fishery would in this way be used to compensate the fishermen that choose to leave and, although the remaining fishermen would be footing the bill, it should be recalled that they paid nothing for the original license.

## Summary

What does distinguish output and input-controlled fisheries in terms of the costs to management of restructuring is that with the latter it is difficult (in practice at least) to differentiate between management activities (and costs) which are necessary just to maintain the management regime and ensure compliance with it and those which are aimed at reducing excess effort. Nevertheless, differentiation is necessary in determining whether or not the management costs of restructuring are outweighed by the benefits (the improved profitability - management rent - which results).

Restructuring and management plans have to be accepted by fishermen. Patient, time consuming effort is likely to be required. The costs of that effort must be taken into account. Even the best management programmes are likely to produce losers as well as winners. In terms of equity and acceptability there needs to be some mechanism for minimising adverse impacts. This may require a slow, measured reduction of excess capacity rather than an all-out effort to move the fishery to, say, MEY in a short period of time (Crutchfield, 1982). Anderson (1977, p.153) cautions against moving too fast: 'proper regulation must do more than strive for an optimal level of effort; it must also find the proper time path for moving toward it. The exact timing will depend largely upon the speed with which released resources can be smoothly assimilated into other parts of the economy'.

The concluding comment can also be left to Anderson (1977, pp.183-184):

> Any regulation program is beneficial only if it offers a potential net increase in the value of production within the whole economy. Since resources used in the control process will reduce potential output elsewhere, under no circumstances should a regulatory program be instituted where its operation costs are greater than the total benefits it provides ...
>
> In summary, the proper goal of regulation is to harvest the optimal amount of fish at the least possible cost. The institutional arrangements of the regulatory process must be flexible and designed to make resources released from the fishery available for other work in the economy. They should also motivate those who remain in the fishery to introduce improved technologies at the proper rate. The costs of instituting, operating, and enforcing the program must be justified by the potential benefits from regulation. Differing biological and economic conditions will dictate varying sets of regulations: which method should be chosen in a given case depends upon its relative capacity to solve the particular problems at hand.

# APPENDIX K: FISHERY ENHANCEMENT

The impetus for initiating fishery enhancement programs commonly arises from the desire of fishing-dependent communities to protect their livelihoods when faced with the prospect of declining and depleted fisheries. These programs can also be used to increase the sustainable harvest levels where the yields are not in decline or depleted. This has been relatively easy to achieve and is therefore more commonly practised in inland waters, where trout and salmon hatcheries are important in supplementing natural restocking of inland waters. For marine fisheries, benefits from these programs are difficult to capture unless the 'common property' problem is overcome. For this reason, these programs have been difficult to initiate for marine fisheries.

The success of one overseas example is worth noting. Legislation introduced in Alaska enabled salmon fishermen to organise themselves into associations, and by imposing a levy on the value of their catch, were able to introduce enhancement programs to increase yields (Pinkerton 1989). The benefits of enhancement programs can be quite high. Pinkerton reported that for one salmon fishery in Alaska the benefit/cost ratio was predicted to reach 9:1 by 1990. The costs include the levy payments, loan repayments and management.

An Australian example is also of interest. The Tasmanian Department of Primary Industry has been conducting a scallop enhancement research program in an effort to rehabilitate Tasmanian scallop beds which have been largely depleted. The project has been in operation since 1987 and has so far been restricted to reseeding areas of the Great Oyster Bay, on the east coast of Tasmania. The enhancement program is particularly desirable for scallop bed regeneration because natural regeneration is associated with a high degree of uncertainty and failure as a result of natural variabilities and fishing practices[1]. The immobile nature of scallop beds means it is relatively easy to capture the benefits of private investment. There are potential spin-offs from this research, which could eventually be used to rehabilitate other scallop beds or create new fisheries.

[1] The success of scallop recruitment depend to a large extent on a number of natural variables comming together to create a favourable hydrographic regime. One of the most important variables is water currents which determine the degree of retention of water containing larvae close to suitable sea-beds. Martin, Young, McLoughlin and West (1989) suggest that recruitment failure may also depend on the current fishing practice of targeting areas of high scallop density.

The funds for the project have come from a variety of sources. Scallop fishermen have purchased shares in a holding company which will in future manage the fishery and gives investors the right to future harvests. The funds from the sale of shares, which over the life of the project have amounted to $1.6 million, have been used to undertake the research and development required to adapt existing technologies. The Overseas Fisheries Cooperative Foundation of Japan has contributed about $5 million over the same period. It has also provided the technology from Japan and some technical expertise to help the Australian industry adapt the technology to Tasmanian conditions. The Tasmanian government has contributed about $2.5 million. The total cost of the project has to date amounted to about $9.1 million. Commercial harvesting is due to start in 1994-95. The company expects the benefit/cost ratio to be favourable even after consideration of the depressing effect on local prices as supply increases, the costs of research and development and the costs of harvesting.

Enhancement programs are being examined in various State fisheries. For example, the Spencer Gulf fishery is investigating seeding and extension of mangroves within Spencer Gulf. The Pearl Oyster industry, in conjunction with the Western Australian Department of Fisheries, has been researching artificial breeding to augment wild capture stocks. In some cases it is a fine line that distinguishes enhancement programs, aquaculture, and pollution abatement measures which serve to protect and enhance fishery production.

# APPENDIX L: VIEWS ON AN AFZ AUTHORITY

The desirability of having a body to oversee resource management for the whole AFZ was recognised by a number of participants in the inquiry. The following selected quotes are views expressed by participants at the Draft Report Hearings.

Mr Hamer, Principal Fisheries Manager, Marine, New South Wales Fisheries Department, stated:

> In terms of the Australian Fishing Zone Authority, we are happy enough with the philosophy and the ideals ...

Mr McCormack, Acting Director, Fisheries Management Division, Victorian Department of Conservation and Environment, commenting on the difficulties involved in managing the Southern Shark fishery because of differing views held by the various states, stated:

> The establishment of an Australian fishing zone authority could well provide an opportunity to reduce or prevent these sorts of issues, delaying the making of essential management decisions.

Dr Turner, Assistant Secretary, Nature Conservation Branch, DASETT, stated:

> ... the [AFZ] model ... has a lot of attractions for us because whilst any suggestion that anybody should add another layer of bureaucracy to anything is something which we would all be a little bit sceptical about, in terms of a decision-making process what we are interested in is bringing all the relevant interests together at a scale which is appropriate to the problem ... it is not simply just fishing and nature conservation, but there are a whole range of other things such as tourism, offshore oil and mineral exploration, transport ... and something which enables those organisations to get on with doing what it is that they are there to manage but ... when certain key decisions have to be made, or at certain key phases of the decision-making process, there is some process, and as necessary some body, which brings those together for some sort of consultative, and if possible, consensus form of decision-making but with the power to override where necessary.

Dr Turner saw the need for a new institutional arrangement because:

> a lot of the institutions we have developed over the years have developed in a sectoral way and are no longer appropriate for dealing with what most of us would consider the big issues. In fact many of our institutions ... force a separation of environmental and economic considerations and do not do a lot to bring together interests that need to be involved in many of the decisions.

Mr Anderson, Co-ordinator, Marine Conservation Unit, ANPWS, suggested various models whereby overall oversight of the range of activities in the AFZ could be undertaken:

> The first model ... is the shared objectives model under which one would have development of common principles and major objectives implicit in the concept of ecologically sustainable use ... Those principles or objectives would then be applied to all of the agencies responsible for planning of management activities likely to have impacts on the system ... So basically there would have to be general agreement on the overall objectives for management of the Australian fishing zone which would apply to all these agencies involved in managing the various resources ... The next model ... is probably closest to the Great Barrier Reef model, which is an overall planning agency model ... with a single authority involved in planning and co-ordinating the activities of a variety of management agencies operating within that area.
>
> The third one ... is an overall management agency model with a single agency responsible for ... direct management of the activities of all ... users ...

Mr Anderson considered that AFMA:

> ... would be an agency under a shared objectives model ... in the best possible way; that there would be objectives established for overall management of the fishing zone and that the fisheries management objectives would have to tie in with those ...

Mr Kelleher, Chairman, Great Barrier Reef Marine Park Authority, supported the creation of a multiple use, marine protection area (similar in concept to the Great Barrier Reef Marine Park) which would be divided into separate jurisdictions adjacent to each state or territory. These would be joint Commonwealth-State bodies. At the national level there would be an advisory, facilitating and integrating agency but with no overriding powers in terms of joint state based agencies.

> My submission ... is to create a marine protected area that covers the full AFZ adjacent to each state and territory, and that is what I believe should happen in the long run and that, in my view, is the long run hope of ecologically sustainable use of the marine environment, and I really do not have much faith in anything else.

Mr Kelleher stated that such bodies should have an overriding responsibility for environmental matters while agencies managing various activities would continue to undertake their operational management:

> ... within each state and territory there should continue to be agencies responsible for optimising the economic efficiency of individual industries, but within the Australian fishing zone, there should be a separate authority for each state and territory, which should have a mandate between the low water mark or the high water mark and the outer boundary of the Australian fishing zone for the full length of the coast - in that state or territory - with the overriding mandate of ensuring that the agencies responsible for individual sectors and for optimising economic efficiency in each of those sectors are limited in what they do and are constrained in what they do, and private users are constrained in what they do, so as to ensure that ecologically sustainable use actually occurs.

Consistent with this view, Mr Kelleher commented on the relationship between a fisheries management agency, such as AFMA, and a resource management body.

> I endorse personally the role of the Australian Fisheries Management Authority having the objective of managing fisheries on an economically efficient basis but also being responsible for achieving ecologically sustainable use. I certainly endorse that, but I believe they need the support of another agency over and above that agency to reinforce it in its hard decisions ...

# ABBREVIATION

AAT -- Administrative Appeals Tribunal

ABARE -- Australian Bureau of Agricultural and Resource Economics

ABMAC -- Abalone Management Advisory Committee

ABS -- Australian Bureau of Statistics

ADF -- Australian Defence Forces

AFC -- Australian Fisheries Council

AFHRL -- Australian Fish Health Reference Laboratory

AFIC -- Australian Fishing Industry Council

AFMA -- Australian Fisheries Management Authority

AFS -- Australian Fisheries Service

AFTA -- Australian Fishing Tackle Association

AFZ -- Australian Fishing Zone

AFZA -- Australian Fishing Zone Authority

AIDAB -- Australian International Development Assistance Bureau

AIMS -- Australian Institute of Marine Science

AMSA -- Australian Maritime Safety Authority

ANPWS -- Australian National Parks and Wildlife Service

ANSA -- Australian National Sportsfishing Association

AQA -- Approved Quality Assurance

AQIS -- Australian Quarantine Inspection Service

ARSFC -- Australian Recreation & Sport Fishing Confederation

ASIC -- Australian Standard Industry Classification

ASTEC -- Australian Science and Technology Council

ATBOA -- Australian Tuna Boat Owners Association

ATSIC -- Aborigines and Torres Strait Islanders Commission

BAE -- Bureau of Agricultural Economics

BRR -- Bureau of Rural Resources

BTR -- Bureau of Tourism Research

CFAC -- Commercial Fishing Advisory Council

CFBL -- Commonwealth Fishing Boat Licence

CSIRO -- Commonwealth Scientific and Industrial Research Organisation

DASETT -- Department of the Arts, Sport, the Environment, Tourism and Territories

DEET -- Department of Employment, Education and Training

DFAT -- Department of Foreign Affairs & Trade

DILGEA -- Department of Immigration, Local Government & Ethnic Affairs

DITAC -- Department of Industry Technology and Commerce

DoF -- Department of Finance

DoTC -- Department of Transport and Communications

DPFRG -- Demersal and Pelagic Fisheries Research Group

DPIE -- Department of Primary Industries and Energy

DPP -- Director of Public Prosecutions

ECTMAC -- East Coast Trawl Management Advisory Committee

ECTUNAMAC -- East Coast Tuna Management Advisory Committee

EEZ -- Exclusive Economic Zone

ESD -- Ecologically Sustainable Development

FCA -- Fishing Clubs of Australia

FDTA -- Fisheries Development Trust Account

FIRC -- Fishing Industry Research Council

FIRDC -- Fishing Industry Research and Development Council

FIRTA -- Fishing Industry Research Trust Account

FMA -- Fish Marketing Authority

FRDC -- Fisheries Research and Development Corporation

GAB -- Great Australian Bight (Trawl Fishery)

GABCC -- Great Australian Bight Consultative Committee

GABIA -- Great Australian Bight Industry Association

GBRMPA -- Great Barrier Reef Marine Park Authority

GITL -- Government/Industry Technical Liaison Committee

GVP -- Gross Value of Production

IAC -- Industries Assistance Commission

ITQ -- Individual Transferable Quota

MAC -- Management Advisory Committee

MEY -- Maximum Economic Yield

MOU -- Memorandum of Understanding

MSL -- Marine Sciences Laboratory

MSY -- Maximum Sustainable Yield

NFAP -- National Fisheries Adjustment Program

NFC -- Northern Fisheries Committee

NFIC -- National Fishing Industry Council Limited

NORMAC -- Northern Prawn Fishery Management Committee

NPF -- Northern Prawn Fishery

NPFVAS -- Northern Prawn Fishery Voluntary Assistance Scheme

OCS -- Offshore Constitutional Settlement

PMS -- Product Monitoring System

PNG -- Papua New Guinea

PZJA -- (Torres Strait) Protected Zone Joint Authority

QBFP -- Queensland Boating & Fisheries Patrol

QCFO -- Queensland Commercial Fishermens Organisation

QDPI -- Queensland Department of Primary Industry

QFMA -- Queensland Fish Management Authority

QNPWS -- Queensland National Parks & Wildlife Service

R&D -- Research and Development

RAS -- Rural Adjustment Scheme

SADF -- South Australian Department of Fisheries

SAFIC -- South Australian Fishing Industry Council

SASFA -- South Australian Shark Fishermen's Association

SBT -- Southern Bluefin Tuna

SEPFA -- The South-East Professional Fishermen's Association

SET -- South East Trawl (Fishery)

SETFIA -- South East Trawl Fishing Industry Association

SETMAC -- South East Trawl Management Advisory Committee

SGPF -- Spencer Gulf Prawn Fishery

SGWCPFA -- Spencer Gulf & West Coast Prawn Fishermen's Association

SRLZ -- Southern Rock Lobster Zone

SSF -- Southern Shark Fishery

SSFMAC -- Southern Shark Fishery Management Advisory Committee

TAC -- Total Allowable Catch

TBOAA -- Tuna Boat Owners Association of Australia

TDSF -- Tasmanian Department of Sea Fisheries

TOAA -- Trawler Owner's Association of Australia

TSPZ -- Torres Strait Protected Zone

TSPZA -- Torres Strait Protected Zone Authority

TSTFA -- Tasmanian Sashimi Tuna Fishermen's Association

UNCLOS -- United Nations Convention on the Law of the Sea (UNCLOS)

VDCE -- Victorian Department of Conservation and Environment

WAFIC -- West Australian Fishing Industry Council

# GLOSSARY

**Benthic** -- pertaining to flora and fauna found at the bottom of an ocean or lake.

**By-Catch** -- The incidental catch of a fish species which is not the target species of the fishery. Incidental catch is often used synonymously with the term by-catch. These terms can be misleading as incidentally caught species may be of value in themselves, and can contribute significantly to a fishery, biologically, and economically.

There are several categories of incidentally caught fish. They include:

1) non-target species of little or no value (for example, the small and mixed species of fish, 'trash fish', taken in the shrimp fishery), usually not retained, or retained for industrial utilization;

2) non-target species of no market value but that have other values (porpoise in the yellowfin tuna fishery), usually not retained;

3) non-target species of value that cannot be retained because of regulatory measures;

4) non-target or target species of existing or potential market value that are too infrequent or do not comprise sufficient portion of the catch to make separation worthwhile, such species may or may not be retained;

5) target species that cannot be retained because of regulatory measures (size or sex limitations);

6) non-target species of value, but not sufficiently abundant to be the principal target.

**Common Property, Open Access** -- Common property resources refer to resources held or used by all who choose to do so. The term is often used synonymously with 'open access resources'. A resource is common property when it is not or cannot be owned or used by an individual or individual-like entity to the exclusion of others. A characteristic of common property resources of relevance to fishery management is that fishing effort tends to increase until the total revenues derivable from the fishery equal the total costs, ie until the economic rent is completely dissipated.

**Demersal fish** -- Fish found on or near the bottom of the ocean.

**Fishing Effort** -- Fishing effort is a measure of the capacity available or expended to catch fish; nominal fishing effort serves as an indirect measure of fishing mortality. Fishing effort data are useful in studying fish stocks (for example, effort data, when used to calculate catch-per-unit-effort is an important element in estimating the abundance of an exploited fish stock) and in calculating fish mortality caused by fishing and in economic analysis of the fishery. However, a distinction should be made between the use of fishing effort for biological and economic studies.

Biologically, fishing effort is often defined in terms of the intensity or magnitude and deployment of gear or equipment, or may be expressed simply as a unit of time fished by standard units of gear and vessel. A more precise definition of this usage is the 'nominal fishing effort'; this is measured in number of days fished, number of hooks set, etc.

In the economic sense, effort data give a measure of costs in terms of capital (vessels and gear), running expenses (fuel etc.) and labour. Essentially, effort data are used to calculate the total costs and marginal costs of the fishery, which allows one to determine whether or not the economic objectives of the fishery are achieved. It should be noted that a unit-of-effort in the economic sense is different than a unit-of-effort in the biological sense.

**High liner** -- A fisherman who because of his skill and knowledge achieves better than average returns.

**Limited Entry** -- Limited entry is any fishery management scheme that attempts to control the amount of inputs that are sued to harvest the fish stock, ie access to the fishery is no longer completely unrestricted.

**Long lining** -- Long Lining is used to catch fish which are usually dispersed and in relatively deep waters. The line can be up to 130 km long with as many as 2000 baited hooks attached and is supported by a series of floats. The fishing depth is between 50 and 150 metres.

**Maximum Economic Yield** -- A general definition of maximum economic yield (MEY) is that it is the value of the greatest difference between the costs of inputs and the value of the outputs

(catch). It occurs at that level of output where the marginal value of the catch is equal to the marginal cost of harvesting the fish. If the price of the fish varies with the output landed, MEY will occur at the point where the sum of profit to the industry and consumer surplus is maximized (Anderson, 1979). It should be noted that it is the marginal cost and marginal revenue to the fisherman, and not necessarily to society, that is generally used in defining MEY. The maximum economic yield is usually attained at a level of effort less than the maximum sustainable effort level.

**Maximum Sustainable Yield** -- Maximum sustainable yield is the greatest yield that can be removed each year without impairing the capacity of the resource to renew itself. Because of natural variations in stock abundance, MSY is often considered to be the maximum yield available for harvesting under average natural conditions. MSY has been used as a reference point for management purposes to describe the maximum potential productivity of a stock in terms of catch.

**Overcapitalization** -- Overcapitalization results when there is more capital and/or labour operating in a given fishery, or for a specific gear type, than is necessary to capture the allowable catch or to realize the maximum economic benefits from a fishery. Overcapitalization of a fishery tends to dissipate the economic rent that could be derived from the fishery if the capacity was reduced. A situation may develop in which no economic rent is being derived from the fishery (this is often referred to as economic overfishing).

**Overfishing** -- Simply put, overfishing is '... fishing harder ... than some desirable level' (ACMRR, 1979). Yet this definition fails to make a useful distinction, that between overfishing in the sense of overexploitation of the resource (biological overfishing) and overcapitalization of the fishery (economic overfishing).

Economic overfishing exists when a fishery is generating no economic rent primarily because an excessive level of effort is employed in the fishery (see Overcapitalization).

Some changes in the average fish size, in the proportion of young fish in the stock, and/or in the growth rate is inevitable in any exploited fishery. Yet biological over-fishing may create situations in which the fishing mortality reduces the biomass to a level where recruitment and/or growth are

adversely affected. It is useful to distinguish between 'growth' and 'recruitment' overfishing. Growth overfishing occurs when fishing mortality is greater than the rate of fishing mortality at which the average catch per recruit is at a maximum. Recruitment overfishing is defined as a situation in which the spawning stock has been reduced to a level at which the average recruitment to the stock is significantly reduced.

**Pelagic fish** -- Fish found in the surface waters or middle depths of the ocean.

**Poling** -- This method of fishing consists of a pole about 3 metres in length, with a line less than the pole length attached. At the end of the line is a barbless hook surrounded by feathers, commonly known as a 'squid'. When the tuna school is encountered live bait is tossed overboard sending the tuna into a feeding frenzy during which they will bite onto almost anything. This is referred to as 'chumming'. When the tuna take the squid they are hoisted over the heads of the fishermen and onto the deck where the barbless hook slips out allowing the line to be returned to the water.

**Public good --** As distinct from a private good, a public good can be consumed or utilised by one person without it reducing its availability for others. In other words, the good is non-rival in consumption. With many public goods it is impossible or impractical to selectively exclude people from consuming it - if it is available for one it is available for all.

**Purse seining** -- Purse seining involves the setting of a long net in the form of a wall around the school of fish being taken. When the net has encircled the fish its bottom is pulled together so that a purse of netting holds the catch. This purse is then gradually made smaller until the fish are gathered along side the vessel and then taken aboard. Pole boats often cooperate with purse seiners. A pole boat may hold a patch of tuna by chumming whilst the purse seiner plays out its net around the fish patch. As the net is drawn in, the pole boat is able to slip over the cordon formed by the net.

**Real time management** -- On the spot management of fishing fleet operations utilising communication and information systems.

**Recruitment** -- Recruitment refers to one aspect of the population dynamics of a fish stock and can be divided into two distinct processes: recruitment to a stock or population and recruitment to the exploitable phase of a stock. In the first instance, recruitment is the general replacement of fish to a

stock or population. In the second instance, recruitment is the number of fish in a single year-class (usually called a cohort) that enters the exploitable phase of a stock within a given period. Recruitment may also be thought of in terms of 'selection', ie that time when fish become liable to contact with fishing gear and are more likely to be taken. This may involve an actual movement (for example, from nursery areas to fishing grounds) or a change in habit. However, recruitment and selection are distinct concepts: fish may be recruited into the exploitable portion of a fish stock, yet may not be caught by a particular gear, due, for example, to their not being retained by the meshes of a trawl net.

**Resource Rent (Management Rent)** -- A rent is a surplus over and above the 'normal' rate of return. The resource rent component of earnings is the value of the resource being exploited. It is the amount that would be paid for the unexploited resource if an efficient market for the resource existed. Because there is no market for fish in the fishery before they are caught the cost of fish to individual fishermen is zero.

Because of the common property problem, rent from the fishery resource can be dissipated. The excessive fishing effort that results increases the costs of catching fish and reduces the available stock. One aim of fisheries resource management is to prevent this dissipation. For this reason, in this report the term 'management rent' is often used to describe rent accruing as a result of measures to reduce effort from the open access level.

There are practical problems in measuring the extent of the rent. In particular, it should not to be confused with either quasi rents or rents to factors of production other than the fish resource. A quasi rent is a temporary rent and can have various sources. It can result from a short term excess demand that will be eliminated in the long run either through a drop in demand or increased supply. It may be a temporary gain to those who are the first to use a new lower cost fishing technique, until such time as its widescale introduction pushes down fish prices. It can also result from either fishing down or overfishing a stock, where large unsustainable catches are taken. Rents to other factors of production include returns for better than average fishing or industry management skills. For a detailed discussion of resource rent in fisheries see ABARE, 1990b.

**Sashimi Market** -- A high value market in Japan for raw fish prepared in accordance to Japanese customs. There are various grades of fish on the sashimi market. For example, the prices paid for SBT on this market depends on a number of factors including the size of the fish, where and when it was caught, what freezing methods were used and how carefully it was prepared.

**Species, population, stock, unit stock** -- The terms species, population, stock, and unit stock are used for numerous purposes in fisheries literature. Although one can give a definition of these terms, be they scientific definitions or so-called working definitions, the practical application of each ultimately depends upon the extent to which individuals of the species, population, or stock can be identified. The following are offered more as differentiations than as definitions.

Species - '... a species is a natural population or group of populations normally isolated by genetic, ecological, pathological and/or mechanical barriers from other populations with which they might breed.'

Population - for purposes of research and data collection, populations can be defined in the statistical sense as '... all the subjects ... of the kind about which one wishes to generalize from a sample.' In a management sense, population might be considered all the individuals of a certain species inhabiting a specified region. This can be divided into subpopulations which are self-sustaining genetic units. Subpopulation is often used synonymously with unit stock.

Stock - an exploitable group of fish, of which there may be more than one per species, existing in a common spatial arrangement, but with limited genetic exchange with adjacent populations of the same species, at a particular time.

Unit Stock - '... a group of individuals of the same species whose gains by immigration and whose losses by emigration if any, are negligible in relation to the rates of growth and mortality.' The term stock is subject to considerable variation in interpretation and in degrees of discreteness. The differences between stock and unit stock is not always readily apparent or definable. As a consequence, for purposes of fishery management, the terms tend to be used synonymously. It may

be reasonable from a pragmatic perspective, to consider a stock or unit stock as a self-contained population unit, where fishing upon one stock or unit stock has no effect upon the individuals of other stocks of the same species. Given the difficulty of defining these terms, it is essential that a specific and complete description of one's use of the terms be included as an integral part of management actions.

**Sustainable yield** -- Under constant environmental conditions yield can be defined as the level of catch where the population neither increases nor decreases; this level of catch can be maintained on a perpetual basis. Thus sustainable yield is obtained by adhering to some fixed fishing mortality rate.

In practice, with a variable environment, even if the fishing mortality is kept at the level sustained over time, the amount of fish available for exploitation will not always be the same. The stocks may vary in abundance from year to year in response to a variety of changing factors.

**Trolling** -- Trolling was one of the earlier methods used to catch SBT in the Australian fishery. Several heavy lines are pulled behind a moving boat. Each line may have one or a series of hooks attached to it. There is only a small amount of trolling for SBT in the Australian fishery.

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