

# Foundations for Effective Marine Ecosystem Management

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**Abstract.** Marine ecosystems are generally more extensive and complex than terrestrial ecosystems. Our understanding of the ecological relationships and biological processes within marine ecosystems is rudimentary but improving. In addition, our appreciation of the range of goods and services available from the marine environment and demand for competing economic uses of marine ecosystems is growing rapidly. Consequently, existing fisheries management structures focused on controlling the harvesting of single species are perceived as crude and narrow. Indeed, in New Zealand, the Quota Management System (QMS) and Individual Transferable Quotas (ITQ) are sometimes described as impediments to the development of more sophisticated environmental management that could simultaneously encompass a wider range of marine activities. Secure rights to utilize fisheries are bemoaned as a barrier to the reconfiguration of use patterns by Government agencies and are condemned as the origin of conflict. This paper criticises the analysis underlying these attitudes and shows the existing frail private property rights in the New Zealand marine environment to be a necessary but insufficient foundation for the emergence of sophisticated marine ecosystem management. With this quality of management as a goal, some directions for the evolution of the QMS are deduced.

**Keywords:** Marine Ecosystem Management, Property Rights, Quota Management System, Incentives, Allocation.

## 1 INTRODUCTION

There is widespread agreement that an eco-system based approach to fisheries management is both necessary and desirable. The Reykjavik Conference on Responsible Fisheries in the Marine Ecosystem held over the first four days of October 2001 focused on the key scientific issues of ecosystem-based fisheries management (EBFM). Experts agreed that a more integrative and holistic view of fisheries management would be beneficial. EBFM is notably short on specifics however.

The European Commission's review of the Common Fisheries Policy gives prominence to multi-annual, multi-species and ecosystem-oriented management. Once again, there is little by way of specifics. Neither is there a discriminating assessment of the effectiveness of particular technical measures.

*“Even if there are no panaceas for the conservation problems, the current critical situation of many stocks makes it more urgent now than ever to apply effectively the whole panoply of available tools.”<sup>1</sup>*

Even more recently, the World Wildlife Fund (WWF) has published a policy paper titled “Policy Proposals and Operational Guidance for Ecosystem-Based Management of Marine Capture Fisheries”

*“In the marine environment, WWF’s approach to Ecosystem-Based Management is to foster area based management across the oceans. This would result in selected intensively managed and defined production environments and comprehensive, adequate and representative networks of highly protected areas...WWF believes that stakeholders must explicitly state their management objectives for production (including the harvesting of fish), for biodiversity conservation and for other values and incorporate these into an ecosystem-based spatial management framework.”<sup>2</sup>*

WWF observes that there are many effective sustainability initiatives operating in different individual fisheries around the world, but they remain to be integrated into what is regarded as a fully effective ecosystem-based management approach. Although smaller than the European Commission ‘whole panoply’ management toolkit, production and use could conceivably be controlled by a range of instruments. Any such use would be ‘intensively managed’, would be confined to areas outside of a comprehensive network of reserves and require a full and prior ecological risk assessment.

Decisions would be made under a precautionary approach to fisheries management that errs on the side of conservation.

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<sup>1</sup> European Commission, Green Paper “The Future of the Common Fisheries Policy” Volume 1, page 22. Brussels, 20.3.2001 COM (2001) 135 final

<sup>2</sup> World Wildlife Fund, “Policy Proposals and Operational Guidance for ecosystem-Based Management of Marine Capture Fisheries” 2002, page 8.

*“A comprehensive precautionary approach to fisheries management relies on three important elements. These are (1) a policy that has been set to be explicitly precautionary; (2) an assessment process that is precautionary in that it fully considers and incorporates uncertainty, and (3) the burden of proof for demonstrating that there are no major unacceptable impacts rests with the fishery.”<sup>3</sup>*

The WWF paper does not really deliver on its claim to provide operational guidance. It is particularly weak in its assumed processes for stakeholder management. *“Involve stakeholders in all aspects of the management system leading to shared and agreed individual and collective aspirations for the resource and associated ecosystem.”<sup>4</sup>* This typical blithe statement denies the scarcity and conflict that lie at the heart of many serious fisheries management problems. The operational requirements for information and knowledge are also impractical given the constraints placed on the modest application of ‘trial and error’ resulting from the particular interpretation of the ‘precautionary approach’ favoured within the paper.

A separate but contemporaneous process has brought policy development in New Zealand to a very similar position to that of the WWF. This has been associated with at least four years of intensifying rhetoric within New Zealand about management of the marine environment. In 1999, the New Zealand Prime Minister signed the Ocean Charter developed by UNESCO in 1998 (The International Year of the Ocean). This brief charter is non-binding and seemingly innocuous. For instance:

*“...The health of the oceans and the wise, safe and sustainable use of the ocean resources, should be an axiom for all governments to accept and honour for the long-term benefit and existence for their respective and collective peoples.*

*The acquisition of the knowledge necessary for the understanding and stewardship of the oceans and their adjacent seas for the adoption of policies, standards and regulations to protect the ocean environment and to husband their resources, are goals to be pursued both nationally and internationally...<sup>5</sup>”*

This ‘interest’ in the marine environment was one factor that stimulated the production of a 111 page report by the Parliamentary Commissioner for the Environment “Setting Course for a Sustainable Future: The Management of New Zealand’s Marine Environment” (implying that New Zealand had no course). In turn, that report recommended that the Prime Minister establish a Coastal and Oceans Task Force to establish goals and principles, and actions and policies for the future sustainable management of New Zealand’s marine environment. This was duly done and the Task Force is now preparing to embark on a second round of consultation.

The Vision statement for Oceans Policy is:

*“Healthy Oceans: New Zealanders understand marine life and marine processes and accordingly take responsibility for wisely managing the health of the ocean and its contribution to the present and future social, cultural, environmental and economic wellbeing of New Zealand.”<sup>6</sup>*

The expectations created by this vision are high indeed:

- All of the values and aims of society will be satisfied
- All of the management problems will be addressed wisely (and successfully)
- We will make no mistakes
- We will work through consensus

It is pointed out that there are fourteen Government agencies involved in the regulation of aspects of the marine environment and its uses. As this fragmentation of roles and associated ad hoc decision-making is described as a problem, a consolidation

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<sup>3</sup> Ibid page 14

<sup>4</sup> Ibid page 19

<sup>5</sup> UNESCO, The Ocean Charter, 1998

<sup>6</sup> Oceans Policy website

of bureaucratic and regulatory responsibilities is anticipated. This raises the question of the ongoing place of existing fisheries management arrangements and their relationship to Oceans Policy.

In New Zealand, the Minister of Fisheries (the Honourable Pete Hodgson) is also the Minister Responsible for the Development of an Oceans Policy. During his address to the International Institute of Fisheries Economics and Trade in Wellington on 19 August 2002, Minister Hodgson, posed this very question and issued the following dual challenge to the assembled fisheries economists:

*“...rights-based management has served us well in the management of fishstocks and has given us a good start in managing environmental issues associated with fishing. With further development, it should better address environmental issues. But the challenges of managing fisheries to achieve both good economic and good environmental outcomes is certainly not the biggest problem on my agenda at the moment.*

*The bigger challenge is to manage our total interaction with the marine environment. We need a good policy framework and we need better management instruments. The Oceans Policy can provide the policy but we need better management instruments if the Oceans Policy is to be most effective.*

*So my second challenge to you – and your colleagues working in non-fisheries areas of marine resource management – is to build on the rights-based frameworks that have been so successful in the fisheries context to help us manage the wider marine environment. I want to hear from people like you about how a rights-based framework could contribute to achieving the integrated comprehensive management framework for the marine environment that we all agree is so important.<sup>7</sup>”*

This paper is intended to provide a straightforward response to the two challenges issued by Minister Hodgson:

- 1) How to better incorporate ecosystem considerations into fisheries rights.
- 2) How to extend rights-based systems to incorporate other uses of the marine environment.

The fisheries rights discussed in this paper are individual transferable quota (ITQ), as attenuated by the New Zealand quota management system (QMS).

## **2 PROBLEMS OF MARINE ECOSYSTEM MANAGEMENT**

The focus of this paper is on the identification of effective mechanisms. In contrast to the ‘vision based’ Oceans Policy process, the starting point for analysis is an examination of the performance of actual management mechanisms and identification of the problems that are manifest or predictable within the framework for use of the marine environment. This starting point is therefore a clear definition of the real problems and issues that must be addressed by ecosystem-based management. WWF see the issues as follows:

*“The issues seem clear enough, that fishing effort is too high, coastal development continues to destroy crucial fisheries habitats, nutrient runoff continues to pollute bays and estuaries...<sup>8</sup>”*

These are certainly pressing issues in many parts of the world, but this list of problems is too short in that it does not mention the economic issues of competition for scarce resources or the destruction of potential welfare through economic inefficiency. There appear to be six problems that must be addressed by an effective marine ecosystem management regime.

### **1 Controlling Fishing Effort**

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<sup>7</sup> Hodgson P., Address to IIFET 2002 Conference, Victoria University, Wellington, 19 August 2002.

<sup>8</sup> World Wildlife Fund, “Policy Proposals and Operational Guidance for ecosystem-Based Management of Marine Capture Fisheries” 2002, page 5.

In most places with developed and valuable fisheries the main threat to marine ecosystems is excessive fishing effort. While single stock management is often derided as insufficient to ensure ecosystem stability, the absence of effective single stock controls is clearly the major practical problem to be addressed in many jurisdictions. A precondition for ecosystem management is that the use of target stocks must be controlled and sustainable.

## **2 Promoting the Economically Efficient Utilisation of Target Stocks**

There are many mechanisms employed to control fishing effort. These include licensing, the setting of catch limits, closed seasons, effort and technology restrictions. Many of these restrictions suppress effort through the deliberate imposition of costs. Those costs may take the form of over-capitalisation, that in turn results in increased harvesting potential and pressure elsewhere. Most societies would accept that the value of scarce resources should be maximised – not suppressed. The use of target fish stocks should therefore generate net benefits.

## **3 Managing Interactions Between Target Fisheries**

The harvesting of one fish stock frequently gives rise to external effects on others. These effects may be through by-catch or incidental mortality. These effects may alter the relative abundance of predator or prey species. Even when the stocks of all target species are being managed at sustainable levels, there are frequently opportunities to increase the benefits available from multi-species fisheries if their management is integrated and harvesting strategies co-ordinated. An ecosystem management approach must provide a practical framework for such co-ordination.

## **4 Managing Interactions of Fishing With non-target Species and the Benthate**

The harvesting of target species can be associated with incidental mortality or effects upon non-target species such as sea birds, marine mammals or corals. This class of effect should be distinguished from the one above, which is internal to the fishing industry or fishing communities. An ecosystem management approach should ideally confront all people with the opportunity costs of their activities. Equally, the proponents of preservation should ideally confront the opportunity costs of precluding uses.

## **5 Managing External Effects of Land-based Activities on the Marine Environment**

These effects include pollution, sedimentation and coastal habitat destruction. Ecosystem based management must recognise that while the external effects of marine environment users are generally confined to the marine environment, the same is not true for many users of land.

## **6 Management of Inter-sectoral Competition for Scarce Resources.**

Competition for marine resources is not confined to various classes of fishers, but between fishing, aquaculture, mining, waste disposal and an increasing range of active and passive uses of the marine environment. The incorporation of new, beneficial uses into the existing patterns of marine use is a major challenge for any management regime. The objective must be to accommodate growth in demand for marine goods and services while protecting the capacity of the environment to supply that full range of services sustainably.

## **3 THE QUOTA MANAGEMENT SYSTEM AND ECOSYSTEM MANAGEMENT**

The WWF paper contains a section titled “The Rights to Fish – An Ecological Critique of Individual Transferable Quotas.” This critique concedes that ITQs in Australia, Canada, Iceland and New Zealand have improved economic efficiency. However, it points out that ITQs are not, by themselves an effective conservation measure if the Total Allowable Catch is set too high. While TACs can recognise some ecosystem effects, other controls may be necessary to protect other components of the ecosystem such as juvenile fish and non-target species.

ITQs are also considered by WWF to be inequitable as their introduction is often associated with a concentration of fishing rights in fewer hands. Of course, a significant reduction in fishing effort will normally be associated with a reduction in the

number of fishers. Increasing efficiency is also generally associated with increasing catch per unit effort or increasing catch per fisher.

Finally, WWF observes that ITQs are not ‘true property rights’ because individuals can potentially accrue short term benefits through practices such as mis-reporting or high-grading while escaping most (or all) of the long term costs of that action. To the extent that the WWF critique of ITQ is generally valid, it consists of two non-controversial observations:

- The allocation of ITQ does not, by itself, constitute an effective fisheries or marine ecosystem management regime.
- ITQs are generally weak property rights with correspondingly weak incentives.

## **THE PERFORMANCE OF THE NEW ZEALAND QMS**

Although New Zealand is described as having a rights-based fisheries management regime, the QMS has been applied only to the main commercial species to date. More commercial species are managed outside of the QMS than under it. Furthermore, the QMS is a relatively sophisticated regime comprising mutually supporting data collection, research, regulatory control, compliance and administration.

The allocation of ITQ is a central part of the QMS but ITQ is heavily attenuated by the QMS. The fisheries management regime enfolded ITQ has not remained static but has evolved as new information and new concerns have emerged since the establishment of the QMS in 1986. In its present form it has proved capable of effectively addressing the first two problems of ecosystem management above and also demonstrates potential to address the next two problems.

### **Controlling Fishing Effort**

The New Zealand QMS has proved to be very effective at this task. Where significant TACC cuts have been required in order to move stock sizes towards those that would produce Maximum Sustainable Yield (MSY), those cuts have been made.

### **Promoting Economic Efficient Use of Target Stocks**

The New Zealand Commercial fishing industry is an unsubsidised export industry that pays its full share of fisheries management costs. ITQ is the largest capital asset of the industry and purchasing access to ITQ is the largest operating cost in many fisheries. The ability of the industry to compete internationally with this capital and cost structure is testament to its efficiency.

### **Management of Interactions Between Target Fisheries**

To date, there have been few examples of this activity. One example is provided by the co-ordinated management of the Challenger scallop and Nelson dredge oyster fisheries. These fisheries overlap physically and have an unusually high level of common quota ownership. The existence of the Challenger Scallop Enhancement Company (established 1994) provided a structure for collective action to promote the combined net present value of both fisheries. The management of target fishery interactions requires the prior establishment of quota owner entities that can negotiate binding arrangements between quota owners in the relevant fisheries. These entities are being established, but at present are undertaking few activities on behalf of members – most of which have a single stock focus.

### **Managing Interactions with Non-target Species**

The Ministry of Fisheries is developing an environmental management strategy (EMS) that will add to the existing framework of the QMS. The Fisheries Act 1996 requires any adverse effects of fishing on the marine environment to be avoided, mitigated or remedied. Accordingly, the industry has developed a seal excluder device for use when trawling for squid in order to limit bycatch of New Zealand Sealions. Various techniques have been developed and implemented to reduce seabird bycatch from long lining. Excessive seasonal bycatch of non-target species has resulted in the closure of fisheries by the Minister of Fisheries.

### **Management of Land-based external effects on Fisheries**

The QMS contains no capacity to address such issues. New effects of this kind require authorisation under the Resource Management Act 1991 (RMA) but many effects are from long-standing activities that require no resource consent. While this is therefore not an issue that can be addressed within the confines of a fisheries management regime, the existence of clearer and stronger property rights within the marine environment would provide a basis for negotiation between affected parties.

### **Management of Inter-sectoral Competition for Scarce Resources**

The QMA has no framework for addressing inter-sectoral allocation issues. The absence of such a framework is the most glaring failure in the existing legal framework for the management of the marine environment in New Zealand. Paradoxically, the QMS is now criticised from some quarters for being too narrow. However, it is surely a weak criticism that it is fit for its originally intended purpose, but not other purposes. The Parliamentary Commissioner and the Department of Conservation have an ambivalent attitude towards the QMS and ITQ. While it is not possible to deny the power of the QMS to greatly improve both the effective sustainable management of stocks and the economic efficiency of this use, anything less than perfection is criticised: *“the current fisheries management mechanism, however is neither economically efficient, nor ecologically effective. The mechanism does not provide a basis for pricing all rights, and there is virtually no assessment of currently non-commercial costs and benefits.”*<sup>9</sup>

The framework of private property rights at the heart of the QMS is seen as an obstacle, not a strength. *“The dominance of the private property rights approach has, to differing extents, excluded the values and priorities of tangata whenua\*, recreational users, local residents groups and other concerned groups from policy and decision making processes.”*<sup>10</sup>

The Department of Conservation develops this theme. *“The essential problem is the tension between the property rights framework developed for fisheries with the very diverse ‘public good’ management framework in place for the management of other activities and values in the marine coastal area.*

*...Particular difficulties arise with the QMS. Currently ITQ holders have a right to access fish. They do not own the fish and although broad spatial rights are implicit they do not have geographic or spatial rights to any particular part of the QMA.”*<sup>11</sup>

The QMS is not, and does not pretend to be, a comprehensive property rights framework for the marine environment. This does not make it a problem.

### **SUGGESTED REFINEMENTS TO THE QMS**

The first four problems of marine ecosystem management described above are fisheries management problems. The last two problems concern interfaces between fisheries management and the management of other activities, both on land and within the marine environment. There is some obvious potential within the application of the QMS to improve its fisheries management performance. These refinements include, extending the QMS to more species, the development of stakeholder management plans, the clarification of the statutory interface between the Fisheries Act and Protection Statutes and the better integration of non-commercial fisheries into the management regime.

### **Extension of the QMS**

The QMS has demonstrated significant benefits when applied to commercial fisheries that require active management. There are probably at least 50 species in this category currently outside of the QMS. Historically, the expansion of the QMS has

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<sup>9</sup> Parliamentary Commissioner for the Environment, *Setting a Course for a Sustainable Future: The Management of New Zealand’s Marine Environment*, 1999, page 70.

\* tangata whenua: people of the land, Maori recognised as local to particular area

<sup>10</sup> Ibid, page 97

<sup>11</sup> Department of Conservation, Internal Correspondence, 12 February 2001 (released under the Official Information Act).

been impeded by the injunction that led to the negotiated settlement of Maori claims, resource constraints in the Ministry of Fisheries and the Quota Registry and uncertainty over the content of the 1996 Fisheries Act. All of these constraints have been removed and the time is ripe to replace the ad hoc non-QMS management of fisheries with proper management under ITQ.

### **Fisheries Management Planning**

Section 11A of the 1996 Act contains provision for the Minister of Fisheries to approve Fisheries Plans that must be taken into account when the Minister is contemplating setting any sustainability measure for the relevant fisheries. This section creates an opportunity for the development of plans by right-holders that will be funded and implemented by right-holders directly. Section 11A provides a means by which the positive incentives created by ITQ to preserve and enhance the value of fisheries can be translated into effective action. Planning and the direct implementation of plans requires the prior establishment of quota owner organisations. Fostering the creation and development of these organisations is therefore the second suggested enhancement of the QMS.

Fisheries management plans are a potential vehicle for customised fisheries management measures that are more responsive and flexible than those imposed through Government regulation today. Plans also have the potential to implement effective negotiated multi-species management strategies. The current statutory default management objective for QMS fisheries is unattainable. It targets the stock size that will produce MSY for all elements in an ecosystem. The goal of simultaneously maximising physical yield from all species in an ecosystem is not consistent with the goal of maximising economic value.

### **The Fisheries Act and Protection Statutes**

The Purpose of the Fisheries Act 1996 is to “provide for the utilisation of fisheries resources while ensuring sustainability.” The main mechanism under the Act for achieving this purpose is the QMS, which has proved an effective means of managing commercial fisheries, has accommodated a rights-based Settlement of Maori claims and to a limited extent is integrated with recreational fisheries management. The self-interest of ITQ owners is to maximise the net present value of quota. Achievement of this objective requires a strong stream of anticipated harvesting benefits over time (sustainability). These positive incentives exist wherever the property right holders can mostly capture the benefits of good management.

Equally, they are absent where the benefits of good management are delivered in the form of public goods. In short, the QMS is a powerful framework that encourages trade-offs between private interests within fisheries and makes sustainability a private good. However, it cannot internalise trade-offs between private goods and public goods. At present there are misguided attempts to provide for protection (a public good) under the Fisheries Act and also within the framework of the QMS. This prevents a transparent comparison of private costs and public benefits.

The opportunity cost of utilisation is the benefit of foregone preservation. The opportunity cost of preservation is the benefit of foregone utilisation. The Department of Conservation has a clear mandate to advocate preservation interests. However, there is no equivalent advocate for the interests of utilisation. In fact, the Minister of Fisheries is required to implement population plans approved under the Wildlife Act or the Marine Mammals Protection Act. Effectively this makes the Minister of Fisheries an agent of the Minister for Conservation.

The purpose of the Fisheries Act is to provide for utilisation (not non-utilisation/protection) and activities inconsistent with this purpose should be eliminated from it. By the same token, a similar confusion seems to lie behind the concept of population management plans prepared under preservation statutes. These plans presume that the species in question does not require protection but can sustain managed utilisation. The third suggestion is therefore to ensure that utilisation statutes confine themselves to the management of utilisation and preservation statutes confine themselves to preservation, thereby providing a clean margin where the relative costs of managing species under one or other framework can be easily compared.

### **Better Integrating Non-Commercial Interests**

A fully integrated QMS would provide for trade between commercial, customary and recreational right holders. This presupposes both explicit and fungible rights along with entities with the power to authorise transfers of those rights. In New Zealand, there is strong opposition from recreational interests to the concept of more explicit rights for that sector. Non-

commercial interests assert a priority access to any TAC and this is the current practice. The statutory basis for this priority is unclear. Plainly, the emergence of a fully integrated QMS is some time distant.

In the meantime, the present TAC setting practice severely undermines the incentives of the QMS. Strategies to rebuild fisheries are implemented through TACC cuts. In other words, only the commercial sector carries the cost of the rebuild. However, there is no guarantee that the commercial sector will receive the benefit of the rebuild in the form of future TACC increases. In fact, the Minister explicitly reserves the right to transfer such 'headroom' to other fisheries sectors. This explains the resistance of the commercial sector to TACC cuts in fisheries where there is strong recreational interest. They understandably resent the imposition of sacrifices for the benefit of others who take no equivalent responsibility for good fisheries management.

The fourth suggested change is therefore to establish the rule that TAC increases should be allocated to fisheries sectors in proportion to the size of the historical cuts in their catch that secured the TAC increase. TAC increases would not provide an opportunity to alter relative shares of sectors under the TAC.

## THE AQUACULTURE MORATORIUM

The four suggestions above are not a comprehensive response to the Minister's first challenge, but they would constitute a substantial improvement to the QMS. However, Minister Hodgson made it clear that the refinement of the QMS is not the largest problem he faces at present. That problem is the breakdown of the ability of Government to provide for the future expansion of marine aquaculture in New Zealand. This crisis has led to a moratorium on the processing of all new aquaculture consent applications by the Government. The moratorium is a confession that the current regime is incapable of addressing the sixth problem of marine ecosystem management (the management of inter-sectoral conflict for scarce resources within an overall framework of sustainability).

Conflicts between aquaculture and wild fisheries harvesters have been building for twenty years but tensions have increased dramatically recently. The core of this conflict is competition for coastal space and the productive capacity of the marine environment. Productive capacity is both valuable and scarce in several localities around the New Zealand coast, especially in Tasman Bay, Golden Bay and the Marlborough Sounds. This conflict has been fought out with great cost and acrimony but with little resolution before the Environment Court.

There are no property rights in the productive capacity of marine ecosystems *per se* but rights to it can be obtained implicitly in association with ITQ, spatial rights and various aquacultural rights. This implicit approach has several major flaws. These are compounded by the dual jurisdiction exercised by Government under the RMA and the Fisheries Act. Under the status quo there is no effective framework to protect or enhance the total productive capacity of marine ecosystems, allow rational adjustments between competing uses and accommodate the beneficial introduction of new uses.

Under the Marine Farming Act 1971, aquacultural rights could be issued if it was considered that aquaculture was a higher and better use of marine resources than the existing use (normally commercial fishing). Comparisons often considered gross revenue rather than profit. This national benefit framework has been superseded under the RMA by consent decisions based upon likely environmental effects. Officials and Council functionaries have been slow to adapt to this change. Both the Ministry of Fisheries acting under the Fisheries Act and Regional Councils acting under the RMA have been required to consider the possible undue adverse impacts of any proposal on fisheries and to ensure that any such effects are avoided, remedied and mitigated. Under these statutes, the effects in question are not economic, but biological effects on the organisms themselves.

The 'effects based' analysis of the RMA appears to work satisfactorily on land, but its transfer into the marine environment has proved problematic. The implications of this statutory requirement are much more onerous in a marine context. On land, heavily modified and simplified ecosystems are the norm, effects are usually localised biologically and internalised economically. The exact opposite is true of most marine situations. Furthermore, the maintenance of future benefit streams from marine ecosystems seems to be far more dependent upon retaining their 'natural' complexity and structure, than is the case on land.

For instance, it can be argued that all new extractive uses of marine ecosystems have undue effects. The reasoning for this is based upon basic ecological principles expressed in the common phrases "nature abhors a vacuum" and "the balance of



nature”. Competition and natural selection drive species to utilise the available primary productivity of their ecosystem efficiently and therefore new uses or extractions of that primary productivity can only be achieved at cost to (undue effect upon) some existing species and by change to the structure of their community.

It follows, therefore, that the introduction of new filter feeding aquaculture activities to an ecosystem could not be approved if the denial of that primary productivity to other species would be an undue effect on them. Weighty issues like this underlie the current aquaculture moratorium. The Ministry of Fisheries is becoming aware of this problem and has started to discuss the idea of allocating shares in the productive capacity of marine ecosystems. The consequence of transferring RMA phraseology developed for land based resource consents into a marine environment has taken some time to fully manifest itself. It is increasingly clear that the real result however, is the possible imposition of a major legislative barrier to aquaculture expansion.

The current statutory regime for the management of marine ecosystems has few defenders. It is widely regarded as incomplete, bureaucratic, ineffective, ecologically inappropriate, economically wasteful and in need of reform. Any reform must be grounded in an understanding of marine ecology and economics. The differences between marine and terrestrial ecosystems have profound implications for appropriate institutional design. The current absence of strong property rights in the marine environment also gives rise to a particular (and damaging) set of economic imperatives.

### **Marine Ecology**

The basis for nearly all life in the sea is the photosynthetic activity of aquatic plants. *Pelagic phytoplankton, (including cyanobacteria) are responsible for perhaps 95% of all marine primary productivity*<sup>12</sup>. The primary productivity of marine ecosystems is affected by light and nutrient levels, which, in turn, can be affected by the degree of turbulence and mixing occurring. Marine and land ecosystems comprise three basic trophic levels in the food chain (autotroph, herbivore and carnivore). Unlike land systems, however, many of the autotrophs and herbivores in the marine environment are microscopic, live in free suspension and are short lived. Marine ecosystems tend to have more trophic levels than terrestrial and there is considerable blurring between these levels in the sea. Filter feeders (which have few land equivalents) consume whole organisms on the basis of size, rather than type. Moreover, some fishes as they grow, switch from herbivorous to carnivorous diets.

Although the population densities of species fluctuate with environmental conditions, it is normally possible to identify characteristic marine communities in which common species remain common and rare species remain rare. In other words, there is a “balance of nature” within ecosystems which assures full and competitive utilisation of their primary productivity over time.

These basic ecological facts and principles are worth restating because successful management institutions must be designed to match them. They also warn us why the simple transfer of resource management arrangements, which evolved on land, may not work in the marine environment. For instance, primary production on land is dominated by large sessile plants. This means that land based ecosystems can be more readily subdivided because the sites of primary productivity and its subsequent utilisation are coincident. Land based property rules are generally designed to accommodate agriculture and production forestry – not the management of wildlife.

In contrast, plankton is not confined, marine species are often mobile or migratory and species of most commercial interest to us are often high-level carnivores with a complex natural food chain below them. Although marine ecosystems are generally poorly understood, at least we understand that they are large, complex and the flow of benefits we receive from them depends upon the ecosystems being kept in a “natural” state. This does not mean a pristine, or virginal, state as such ecosystems have no net surplus production available for human removal. Rather, it means 'natural' in the sense that the range of species and the broad pattern of their inter-relationships is maintained. All of these points are constraints upon the design of new policies, laws and structures.

### **Marine Economic Imperatives**

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<sup>12</sup> Nybakken, James W, *Marine Biology An Ecological Approach*, Third Edition, Harper Collins *College Publishers*, 1993

Property rights analysis can explain much about the current tensions between aquaculture and fishers and can thereby also suggest some potential solutions. It is well understood that dissipation of value and the unsustainable use of many fisheries worldwide arises because of the open access or common property nature of those fisheries. The mechanics of the tragedy of the commons are driven by three imperatives:

1. *The imperative to exploit the resource before someone else does.*
2. *The imperative to take the most valuable species first.*
3. *The imperative to forego investment that would improve productivity of the resource.*<sup>13</sup>

Once resource use patterns reach “tragedy of the commons” phase, the establishment of exclusive property rights is the accepted prescription. The allocation of ITQ is a partial adoption of this prescription. However, there are four things to note about ITQ:

- It has been issued to a few species only.
- It separates rights to a species from rights in its habitat (which is unowned).
- It is a common property right without a pre-established robust arrangement for collective action by right holders.
- It is often only one of a set of three harvesting rights in a species concerned being ITQ, customary and recreational “rights.” Marine farming consents of different types comprise a fourth category of harvesting rights, which are competitive with the others. Seabed mining, waste disposal, tidal energy systems are examples of the growing list of potential uses and potential categories of rights within the marine environment

While the arguments fought out in front of the Environment Court were couched in the terms of the Resource Management Act 1991 (RMA) they were largely over the allocation or re-allocation of rights to primary productivity. The absence of clearly specified property rights over this resource (the productivity of an ecosystem) is an economic problem which will increase in magnitude as the potential economic rents from this resource expand with an increasing range of possible uses.

The sound management of marine ecosystems requires the establishment of a complete and robust property right to the primary productivity of the ecosystem itself. Neither a single species, nor small exclusive area approach to the specification of the property right will work. Small area rights mean that right holders cannot easily protect themselves from adverse effects that are imposed well away from the boundaries of their rights. Single species rights have not had explicit rights to the underlying primary production that the species depend upon. The specification of new or expanded rights has been complicated by the prior allocation of secure partial rights such as ITQ and marine farm permits. Notwithstanding the current inter-sectoral conflicts, the incentives associated with secure existing rights play an important role in supporting the sustainability and economically efficient use of fisheries. Any change should preserve these incentives.

## **EXTENDING RIGHTS-BASED APPROACHES TO OTHER USES OF THE MARINE ENVIRONMENT**

The crisis represented by the aquaculture moratorium can only be addressed by fundamental institutional reform. Plainly, what is needed is a new arrangement that will protect the productivity and complexity of marine ecosystems yet can also accommodate new uses that generate higher rents than the status quo while confronting all users with the full costs of their actions. The regime should provide a secure environment for investment while allowing adjustments through trade. No such arrangement exists anywhere at present.

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<sup>13</sup> Keen, Elmer A, Ownership and Productivity of Marine Fishery Resources An Essay on the Resolution of Conflict in the Use of the Ocean Pastures. The McDonald and Woodward Publishing Company Blacksburg, Virginia 1988

There are two possible approaches to marine ecosystem management. They are mutually exclusive. One is to expand the role of property rights, so that property right owners are better able to ‘internalise’ a fuller range of ecological and economic effects within their decision-making. The other is to prohibit or regulate uses of the marine environment more extensively. This would immerse Government in an increasing range of economic and commercial judgements about resource use and its reconfiguration over time.

### **Regulatory Approach**

The problems with regulatory approaches are widely recognised in New Zealand and were a reason for the introduction of the QMS in 1986. In brief they include:

- The problem of information and knowledge. Much valuable information about the marine environment cannot be easily centralised.
- The problem of incentives. Bureaucratic decision makers do not face the consequences of their decisions.
- The problem of inflexibility. Bureaucratic rules can be extremely complex, but never as complex as a marine ecosystem. There is little incentive to depart from established practices, even when these are known to be unsuccessful.
- The problem of responsiveness. The effective management of marine ecosystems is likely to require timely actions beyond the capacity of bureaucratic systems to deliver.
- The problem of cost. Bureaucratic management processes are expensive and competition for administratively allocated consents is a negative sum game.

Notwithstanding the fact that this is the approach that has failed so disastrously in the past, much of the debate about Oceans policy has been focussed on possible rationalisations of bureaucratic agencies and processes to improve regulatory co-ordination. This suggests that improved ecosystem outcomes require greater government activity. It is not yet clear how expanded regulatory activity governing the ‘health of the oceans’ would interact with existing rights such as ITQ and customary rights.

For instance, if the regulatory reform re-instates the capacity of central or local Government to consider “national good” in zoning and consent decision, this would formalise the (probably) uncompensated expropriation of ITQ and possibly confer a preference on aquaculturalists for access to the productive capacity of ecosystems. The negative effect of such a reform on ITQ would undermine the integrity of the Deed of Settlement with Maori. At the same time it would unavoidably give the Government a central role in economic planning and production.

### **Property Rights Approach**

On land, new uses and activities are accommodated over time by trade and the subdivision of existing property rights: sub-surface rights can be split from surface or air rights, surface rights themselves can be split and so on. Strong property rights in land have supported the evolution of complex and intensive uses generating increasing economic benefits over time with generally benign environmental consequences. An important reason for this is that exclusive rights to land provide the owner rights to all known uses of the land, and (notwithstanding the theoretical constraints of estates in fee simple) effective rights to residuary as well. Most importantly, the sessile nature of plants means that any external effects caused by particular uses of that primary productivity tend to be confined to that site.

These observations indicate that, for property rights to be equally successful as the means for governing productive and sustainable use of marine environments, two things are necessary. First, a strong property right is required that can be traded and sub-divided so as to accommodate the generation of all conceivable private goods plus residuary ( the right to benefit from any new private uses of the marine environment that are discovered in future). Second, that property right should preferably cover an area sufficient to minimise geographic spill over effects from uses and activities carried out under that right.

The key decisions are to determine the manner in which the ecosystem right would be specified and how that would relate to the existing framework of property rights represented by the QMS. There appear to be three possible approaches to the specification of a strong right that could internalise future decisions about marine ecosystem use.

- 1) Strengthen an existing use right such as ITQ.
- 2) Create a property right in the primary productivity of the marine ecosystem itself.
- 3) Create a property right to issue use rights in the marine environment.

The first approach might be effected through a dramatic extension in the QMS to include every species in marine ecosystems including phytoplankton and cyanobacteria. A comprehensive and fundamental property right framework would be created through the aggregation of harvesting rights. Theoretically, behind every ITQ harvesting right lies an implied right to some of the primary production of the ecosystem. If ITQ was protected by a clear liability rule, any new use of the environment that reduced or diverted some of this primary productivity, or interfered with harvesting activities, would constitute damage to the rights of particular ITQ owners. The liability rule would establish an environment where new uses could be accommodated through negotiation and trade.

There are several reasons why such an aggregation of harvesting rights would be an unsatisfactory basis for integrated ecosystem management:

- The complexity of marine ecosystems with their multiple trophic layers means that the relationship between primary production and the harvesting rights in particular species is indirect and very imprecise.
- There are also complex implicit existing 'supply' contracts governing the nutrition of prey species throughout the food web.
- Most species in the New Zealand do not have harvesting rights with a positive value. Commercial species represent only approximately 120 out of an estimated 8,000 species in the New Zealand EEZ.

Although the extension of ITQ rights combined with a new liability rule creates a framework for commercial negotiation, the transaction costs of negotiating economic rent enhancing arrangements (after compensation of affected right holders) would be prohibitive in many instances. Having noted the problems of a 'bottom up' approach to the creation of property rights in the primary productivity of marine ecosystems, the question arises as to whether a 'top down' approach would be better. For instance, a property right to primary production could be created and the holder of that right could effectively allocate rights to use that primary productivity.

The problems with this approach are that:

- Existing right holders will argue that they (or their species) have implicit rights to shares in that primary productivity already.

Primary productivity is only one scarce resource in the marine environment. There are also conflicts over space, the effects of pollutants and other external effects of marine ecosystem activities on each other. The exclusive right to control the use of primary productivity is therefore not a concept that internalises external effects as successfully as strong property rights in land. The best equivalent property right structure to strong land rights would simply be an exclusive right to allocate all private use rights within a marine ecosystem. The holder of this right would have a strong incentive to maximise the value of those rights over time by finding ways to incorporate new uses with minimal impact on both the environment and existing use right holders. This framework can avoid the serious incentive, information and cost failings of bureaucratic management.

Allocating the right to allocate use rights gives the greatest scope to maximise the potential to maximise economic rents from the complex of resources comprising a marine ecosystem through integrated management. The challenge is to release economic potential without disadvantaging existing right holders or disrupting the smooth operation of the QMS. In a New Zealand context this means protecting the integrity of the ITQ-based Settlement of Maori claims to commercial fisheries.

From these considerations, a set of design principles begin to emerge:

- The goal is to create an effective framework for the integrated management of marine ecosystems (where the need for integrated management is great enough to justify the cost).
- The overall framework is that Government would retain the role of delivering the public good of preservation but utilisation rights would be allocated privately where doing so would increase net rents. Utilisation would have a commercial framework.
- Marine ecosystem management will sometimes involve the allocation and re-allocation of use rights and the possible introduction of new uses of the ecosystem.
- Uses should take place under a secure framework of use rights.
- Any negative effects on use rights by actions of the ecosystem manager should be compensated for.
- The goal of the ecosystem manager should be to maximise economic rents available from the ecosystem, while ensuring that all users and harvesters within the ecosystem face the full costs of their activities. It is understood that the achievement of this goal requires the protection and enhancement, where possible, of the primary production of the ecosystem.

The management framework must be accountable, responsive and cost effective.

### **STRUCTURAL CONCEPT: THE ECOSYSTEM MANAGEMENT COMPANY**

In structural terms the goals and functions identified above could be achieved by the establishment of ecosystem management companies (EMC), entitled to capture the super profits from re-configuring the use patterns of their respective marine ecosystems. Strictly speaking, because the boundaries of marine ecosystems are not easy to precisely delineate, the practical boundaries of the companies would coincide with the boundaries of fisheries management areas (FMAs) or aggregations of FMAs. But the name is apt because these areas are wide enough to allow the internalisation of a wide range of potential management effects. These boundaries would exclude existing marine reserves.

These companies could be entitled to issue use rights such as ITQ or aquaculture rights within their areas. Discharge rights, mining rights, water extraction, tide energy and other uses could also be controlled by the EMC. The EMC could hold use rights itself or sell term or perpetual use rights to other parties. The most flexible arrangement would be to manage the exploitation of use rights as directly as possible. Any reconfiguration of uses would simply be an internal resource allocation. Once issued to another party, use rights could only be unduly affected by the issue of new use rights if the effects are fully compensated by the EMC. The EMC might be entitled to modify use rights without the consent of right holders provided this condition was met.

The RMA would continue to govern the effects of structures on navigation and aesthetics. All other effects on the ecosystem itself and the right holders within that ecosystem would be managed by the EMC under an economic (commercial) framework. If the Government wished to extinguish existing use rights or the right to allocate use rights in an area, it would be required to compensate right holders and the EMC respectively. The Government could contract with the EMC to ensure that all use rights issued contained appropriate environmental obligations. Similarly the Government could transmit its statutory obligation to provide 20% of ITQ in new fish stocks to the Treaty of Waitangi Fisheries Commission on to the EMC.

The Government would establish the EMC and would initially hold all of the shares. A proportion of these shares could be set aside for Maori or other parties and the remainder auctioned. This process would establish a market price for shares in the EMC. A difficult issue in the establishment of an EMC is the lack of precise specifications for existing property rights such as ITQ. In the absence of such specifications, it is unclear what it is that the EMC is obliged to protect. The simplest solution to this dilemma is for ITQ owners to sell their use rights into the EMC in exchange for an equivalent value of shares. ITQ would then be pooled for management purposes. Optimising fisheries use could then be a matter for company management, rather than a complex and costly negotiation between distinct sets of interests.

In order to protect individual sunk investments threatened by the rationalisations implicit in ecosystem management, it could be expected that existing ITQ owners with associated investments in vessels, plant and marketing networks would negotiate term Annual Catch Entitlement contracts, harvesting, processing or marketing arrangements with the EMC. The safest way of ensuring that individual ITQ owners do not suffer loss through the redundancy of other investments such as vessels would be to offer those other assets for sale to the EMC. The costs of rationalisation would therefore be collective rather than individual.

Potentially, the proposal can balance a number of political tensions. ITQ rights would be protected but ITQ owners would not have a veto over the introduction of new activities within the ecosystem in which they have a single species harvesting right. New uses could be accommodated provided owners of new use rights were prepared to meet all of the costs they would impose and that the profitability of the new use exceeds that of the old. The taxpayers would obtain a return on the allocation rights in the EMC. The position of Maori would be recognised and protected by the allocation of a proportion of EMC shares that recognise existing use rights (both commercial and customary). In addition, a proportion of the shares that are not linked to existing use rights but representing interest in residuary could possibly be set-aside for Maori also.

## **CONCLUSION**

Private ownership and management is proving to be the most effective way of achieving the dual outcomes of fisheries sustainability and economic benefit under the QMS. It is also consistent with the principles of the Treaty of Waitangi. The same approach is capable of development and expansion to address the wider ecological and economic issues of marine ecosystem management. This suggests that the practical questions about the mechanisms required to implement an effective oceans policy should really be questions about the extent and the rate that the property rights comprising the QMS can be broadened and deepened.

In particular, dynamic marine ecosystem management entails the removal of Government from the ongoing role of allocating and managing economic use rights in the marine environment. The advantages and disciplines of private property rights can be achieved simply by allocating the right to allocate use rights to a properly structured commercial entity. The Government is then free to focus on the delivery of public goods and services.