

## **MANAGING THE ENVIRONMENTAL EFFECTS OF FISHING, WHAT'S LEFT AFTER PROPERTY RIGHTS?**

Jeremy Helson

New Zealand Ministry of Fisheries, jeremy.helson@fish.govt.nz<sup>1</sup>

Spencer Clubb

New Zealand Ministry of Fisheries, spencer.clubb@fish.govt.nz

### **ABSTRACT**

Commercial property rights in New Zealand are designed to address utilisation and sustainability issues relating to single-stock management. However, commercial property rights may not provide incentives that address environmental impacts of fishing if these impacts do not affect the value of the property right. But is it really that simple? This paper examines the circumstances under which these property rights also benefit the wider ecosystem, highlights where gaps remain and the subsequent implications for managing environmental impacts. For example, as more species enter a property rights-based system, benefits may accrue through reductions in capacity and effort, reduced discarding and an increase in information about fisheries through improved reporting requirements. These changes contribute towards an ecosystem approach to fisheries management. The additional benefits of the rights-based framework may also affect decisions relating to the use of other management tools. For example, in many states, MPAs are advocated as a key fisheries management tool as well as a reservoir of biodiversity. However, where the majority of mobile species are being managed sustainably through property rights, the role of MPAs, and the areas required to ensure ecosystem function may not need to be as extensive. The property rights system may be less effective where there are limits on the incentives that are connected with property rights, such as protected species bycatch or the effects of fishing on the benthic environment. In these circumstances, targeted spatial management or the extension and adaptation of the property rights framework may be required.

**Keywords:** Property rights, quota, ITQ, environmental effects, MPAs, New Zealand, QMS.

### **INTRODUCTION**

In 1986 New Zealand introduced the Quota Management System (QMS) to contribute to the management of New Zealand fisheries. The QMS is now the principal management tool for most of New Zealand's important fishstocks. The QMS sets a Total Allowable Catch (TAC) and allocates that TAC among the recreational, customary Maori and commercial sectors. The commercial sector's allocation is then further allocated to fishers as an Individual Transferable Quota (ITQ).

---

<sup>1</sup> The views expressed in this paper represent are those of the authors and do not necessarily constitute New Zealand government policy.

In most cases, ITQ is allocated in perpetuity to those with a proven catch history in the fishery upon a stock entering the QMS. The New Zealand Court of Appeal has described ITQs as a valuable type of property right, although one that can be lawfully reduced and so not absolute.

Property rights in New Zealand are the right to take the single species to which the ITQ relates. It does not include a right to fish taken in association with the target species or a right to impose collateral damage on the marine environment as a consequence.

Other species or components of the marine environment that may be caught or damaged through fishing target stocks are managed using input controls. For example, the endemic and endangered Maui dolphin has been largely managed through the imposition of a complete ban on set netting throughout their known range.

The QMS is a combination of measures, of which property rights are only one component; supporting tools ensure the integrity of the QMS.

### **Reporting**

The integrity of the QMS requires accurate and timely reporting that allows catch to be monitored, evaluated and balanced against quota entitlements administered by the Crown.

### **Research**

Any output-based quota system relies on good science to guide the setting of catch limits. Property rights allow the government to recover much of the cost of research from industry based on the allocation of quota.

### **Deemed Values**

Deemed values are set for each fish stock in the QMS. The deemed value is a price per kilo fishers must pay for fish they catch in excess of their entitlements.

The purpose of the deemed value framework is to defend the commercial allowance and enable the balancing of all catch. Property rights allow financial disincentives to be targeted at individual fisheries to defend the TAC.

## **PROPERTY RIGHTS IN NEW ZEALAND**

This paper is not intended to be a theoretical description of the potential benefits of property rights when used to manage the environmental effects of fishing. Rather, we look at how New Zealand's property rights framework has contributed to the management of New Zealand's fisheries, the ancillary benefits of that system to the wider environment, and some examples of the benefits and limitations of managing the remaining environmental problems.

Traditionally ITQs are thought of as providing a long term incentive to manage a stock sustainably. ITQs are also thought to promote economically rational behaviour among fishers and promote exploitation in a way that maximises long term economic rent from the fishery.

Generally however, the incentives provided by property rights are often not well aligned with the environmental effects of fishing unless there is a direct correlation between the impact of fishing and fish abundance.

However, for the incentive to manage fisheries sustainably to be optimised, it is important that the QMS operates in such a way that any environmental benefits result economic benefits being returned to the quota holders.

### **Economic rationalisation and increased profitability**

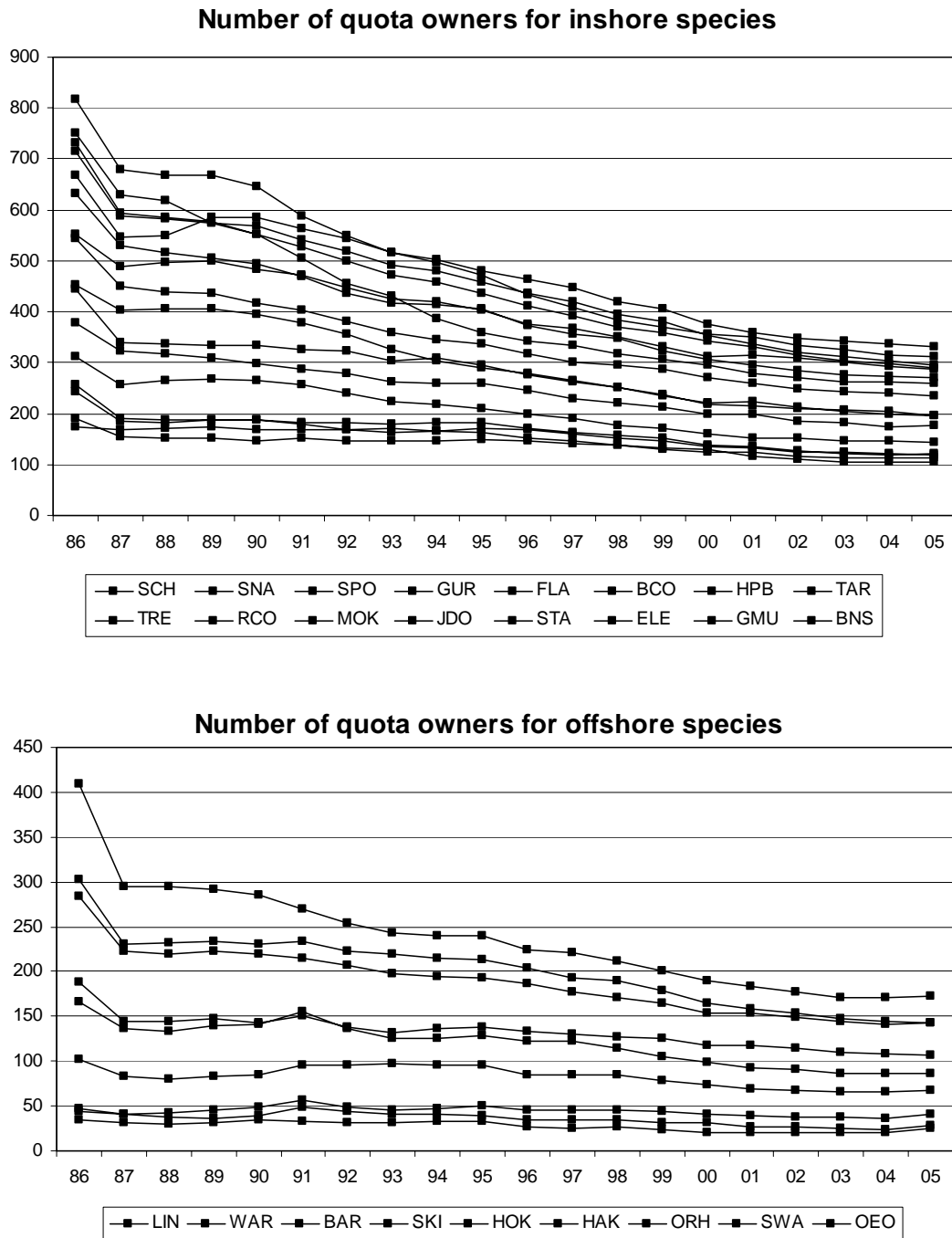
At the time of the introduction of the ITQ system, many inshore fisheries were showing signs of overfishing. The likely consequence is that there would be a reduction of quota owners as economic rationalisation forced the least efficient operators to exit the market.

The number of fishing vessels registered as at the beginning of each fishing year has decreased reasonably linearly from 3232 in 1989 to 1666 in 2004. Similarly, Newell et al. (2005) found an overall decline of 37 % in the number of quota owners since the beginning of the QMS in 1986 to the year 2000. Most of the decline in quota ownership was from inshore species where there was a 46 % reduction in ownership compared to 19 % for offshore species (Fig. 1). Newell et al. (2005) attributed this difference to previous allocation of rights for offshore species before QMS and therefore limited entry and greater pressure on stocks of inshore species.

Although there has been a net exit from the fishery, Newell et al. (2005) found that there has been on average 90 new quota owners entering the market each year since 1990. This has largely been driven by the entry of new species into the QMS.

When the QMS was established in 1986, 33 species were introduced. Newell et al. (2005) found that after controlling for fishing input and output prices, ecological variability and interest rates, the value of quota has increased over the first 15 years of the QMS.

This increase is particularly significant for stocks that were initially overcapitalised and overfished and faced significant catch reductions from historic levels. For these stocks there has been a 9% annual increase in quota price while those stocks that did not face significant catch reductions, quota prices have increased by 5% annually.



**Figure 1. Number of quota owners of inshore and offshore species between the introduction of the QMS in 1986 and 2005. Data are the number of quota holders at the beginning of the fishing year at 1 October<sup>2</sup>**

<sup>2</sup> Inshore: SCH, school shark; SNA, snapper, SPO, rig; GUR, gurnard; FLA, flatfish; BCO, blue cod; HPB, häpuka/bass; TAR, tarakihi; TRE trevally; RCO, red cod; MOK, blue moki; JDO, john dory; STA, stargazer; ELE, elephant fish; GMU, grey mullet; BNS, bluenose.

Offshore: LIN, ling; WAR, warehou; BAR, barracouta; SKI, gemfish; HOK, hoki; HAK, hake; ORH, orange roughy; SWA, silver warehou; OEO, oreo.

## **WHAT PROPERTY RIGHTS DO AND DO NOT MANAGE**

Associated with the application of a property rights system, benefits may accrue to the wider marine environment. The economic rationalisation and increased profitability demonstrated as a consequence of the QMS can provide an opportunity for fishers to realise potential gains from resource stewardship. If the fishery is profitable, or more profitable as a result of property rights, it shows that the benefits of increase productivity etc. can be delivered back to fishers and hence there is better incentive to manage any adverse effects of fishing.

Conversely, Newell et al. (2005) also showed that quota prices decrease with increasing ecological uncertainty i.e. for species with high mortality rate there is a greater variability in stock size and therefore greater uncertainty about future yield from the fishery.

If mortality rate can have an impact on quota prices, this may also imply that variation in stock size caused by management at low biomass or other measures of uncertainty, such as potential government regulation to mitigate ecological problems, may also reduce quota prices.

### **The Benefits**

The first and most obvious benefit of property rights is ensuring target stocks are sustainably managed. Providing TACs are set at appropriate levels, and are defended through tools such as reporting regimes and the application of deemed values, target stocks should not be fished down to unsustainable levels and the aquatic environment should remain in a healthy and functional state.

In the 20 years since the QMS was established, the number of stock in the QMS has grown from about 150 in 1986 to just over 600 in 2006. Additional species that have been added to the QMS include those from various trophic levels, thus ensuring a wider cross section of the ecological community is harvested sustainably. As the number of ITQ species increase, bycatch stocks are monitored more closely. The addition of species to the QMS decreases the likelihood that those species will be fished unsustainably. It also results in increased accuracy of information reported to the government.

### **What remains to be managed?**

Property rights do not work in isolation only on specific target stocks. Single species property rights may not provide an incentive for fishers to avoid some impacts of their fishing activity if that activity does not have the potential to affect the stock size. Some examples include the physical impact of fishing gear on the benthic environment or bycatch of protected species. We now look at examples from New Zealand to see how the property rights regime has influenced management of some of these outstanding environmental issues.

## **MARINE PROTECTED AREAS (MPAS)**

Subsequent management decisions may also be influenced by the implementation of a property rights system. In New Zealand, the purpose of MPAs is for protection of biodiversity, not

management of fish stocks. However, in many states MPAs must fulfil the role of both fishery manager and be a reservoir of biodiversity.

Traditional thinking by some conservationists promotes very large (10-50%) no-take MPAs to manage multiple trophic levels as both biodiversity conservation and a fisheries management tools. However, using an effective rights-based system to manage the extraction of fisheries resources should enable MPAs to be used purely as a biodiversity conservation mechanism.

The ramifications to a potential MPA of biological extraction will differ depending on what is being extracted. The consequences of extraction, from a biodiversity conservation perspective, are greater for species that have a closer ecological relationship with, or are more functionally important to, a potential MPA site.

Many of these important species are benthic dwellers that greatly increase habitat heterogeneity; this has been shown to increase biological diversity. As such, sedentary and less mobile species may have a more important role to play in ecosystem maintenance and recovery at smaller spatial scales (MPA scale).

In contrast, mobile species that range over great distances are unlikely to obtain any real benefit from prohibitions on harvest imposed at small spatial scales. Similarly, if these highly mobile species are harvested inside an MPA their contribution to the system is not likely to be substantially different to that which would be realised solely from harvesting outside an MPA; providing harvest limits are in place and set at appropriate levels.

Hilborn et al (2006) employed population dynamics models and found that anything close to natural abundance will only be achieved for highly sedentary species like abalone. For fish species, even movements of a mile or two per year preclude development of much higher biomasses within MPAs.

Other arguments for increased reserve size include the requirement for connectivity among MPAs. In these circumstances reserves must be large enough to accommodate the normal movements of adult individuals for there to be a true reserve effect. Hilborn et al (2006) have demonstrated that if the average larval dispersal distance is on the order of 40-100km then only a very small fraction of the larvae dispersing from one MPA will randomly land in another MPA. The vast majority will land outside the MPA, thus MPAs will not be connected in any biological sense. Fortunately, under management conditions that provide for the biomass of stocks to be maintained at sustainable levels, the majority of larvae that enter any MPA will come from outside that, or any other, MPA. The requirement for MPAs to be networked in a biological sense becomes extraneous when fishstocks are managed to maintain an adequate level of larval production throughout the fisheries management area.

This implies that the role of the MPA is reduced from managing biological extraction to outstanding environmental impacts, e.g. physical habitat perturbation. Therefore, the focus of MPAs, in the presence of a well managed property rights system, should be on the benthic environment and species that are sedentary or have limited mobility; spatial management is

likely to be more effective in these circumstances. As a result, the role of MPAs, and the subsequent areas required to ensure ecosystem function, does not need to be as extensive.

### **AN INDUSTRY INITIATIVE – BENTHIC PROTECTION AREAS**

There has recently been in New Zealand an example where the governance and mandate derived from property rights allowed industry to move quickly to contribute to the management of the environmental effects of fishing on the benthos. In this case, the property right provided both the incentive and the mechanism for management.

The allocation of rights can, and has in New Zealand, lead to the formation of collectives that have rationalised economic behaviour and led to a more profitable fisheries sector.

The prospect of government intervention to manage the impact of trawl gear on the benthos, or consumer concern over the issue, may act as an incentive to take proactive steps to manage the environmental effects of offshore fisheries. As Newell et al (2005) demonstrated, ecological uncertainty can impact on the value of the property right, by extension, so may the uncertainty caused by government intervention through regulation.

To combat the likelihood of government intervention, The Deepwater Stakeholder Group, that control a significant proportion of offshore quota, has recently proposed to close to bottom trawling and dredging an area of c. 1.2 million km sq, or 30% of New Zealand's EEZ, this area greatly exceeds any government target that has previously been contemplated (Fig. 2).

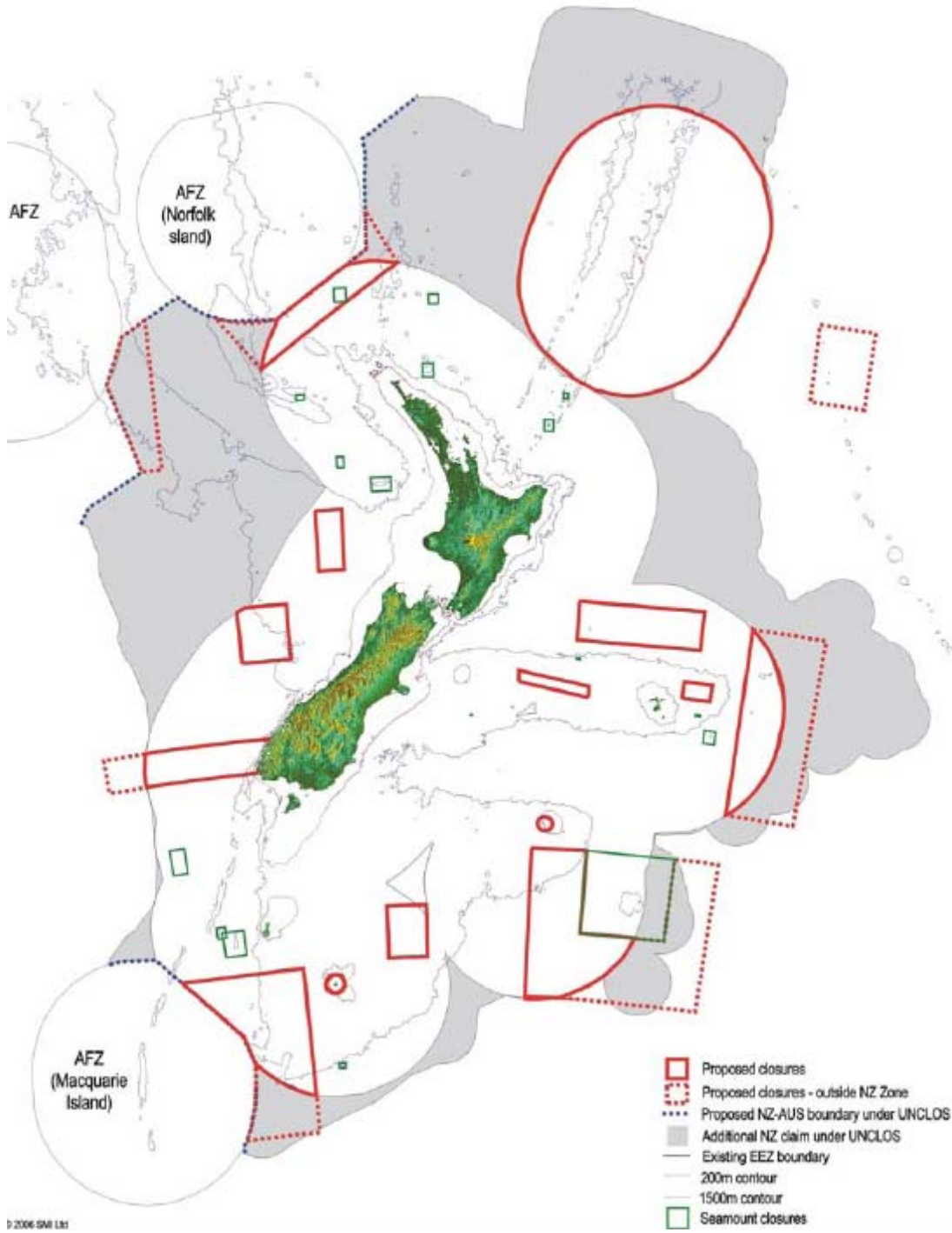
### **SEA LION BYCATCH**

The previous two examples demonstrate how management can be altered by property rights (MPAs) or how property rights may lead to industry-generated initiatives to protect the benthic environment. The last example highlights how property rights may provide both an opportunity and difficulty for managing the adverse effects of fishing.

One important commercial fishery in New Zealand is a squid trawl fishery that operates around New Zealand's subantarctic islands. Nominally, the fishery operates using an output control (ITQ); however, sea lion bycatch is a substantial issue in this fishery.

Each year a fishing related mortality limit (FRML) is set in the squid fishery. This limits the number of sea lions that can be caught in that season. If the FRML is reached the Minister of Fisheries may close the fishery. The FRML has been a constraint on the squid fishery in most of the last 10 years, although the degree to which fishing is constrained varies among years due to the nature of the limit and the availability of squid.

The mortality limit managed using a system of tradeable rights; rather it is calculated prior to the squid season, applies to the whole fishery and is fished competitively. The number of mortalities is not determined by observations of actual sea lion mortalities but by using a pre-determined strike rate of 5.3% of tows undertaken in the fishery. Effectively the fishery operates on an input control.



**Figure 2. Areas proposed to be closed to bottom trawling and dredging by a commercial industry body; The Deepwater Stakeholder Group**



The nature of the limit is such that it provides an incentive to increase effort rather than avoid bycatch. Theoretically there is an opportunity to allocate tradeable rights to sea lion bycatch as an extension to the property rights system. However, the New Zealand government has chosen not to extend the property rights system to incorporate such environmental problems.

The perceived certainty, comfort or simplicity associated with input controls may be the primary reason for not managing protected species using tradeable limits. However, there may also be practical difficulties associated with such a management approach. The currency of any pure tradeable right (not using tows as a proxy) in this situation would be sea lions themselves. This right would require close monitoring and reporting to ensure the integrity of the system. This requirement to monitor and report actual sea lion mortality would confound efforts to reduce mortality using sea lion exclusion devices (SLEDs) or other forms of mitigation that eject sea lions, dead or alive, from the trawl net.

## CONCLUSION

New Zealand's property rights system has been in operation for over 20 years and now contains over 600 fish stocks from a wide range of trophic levels. This system has increased the profitability of New Zealand's commercial fisheries and has led to most stocks being maintained at sustainable levels. This is arguably the most fundamental and important environmental performance indicator of any fisheries management system and is a good first step toward an ecosystem approach to fisheries management.

Although not all environmental problems are solved by property rights, the application of property rights may lead to more focussed use of additional tools such as MPAs, or lead to industry-initiated proposals to further reduce the adverse effects of fishing. There also remain opportunities and challenges to expand the property rights system to manage bycatch of protected species such as the New Zealand sea lion.

## REFERENCES

- Hilborn, R., Parrish, R., Walters, C.J. 2006 California Marine Life Protection Act (MLPA) Science Advice and MPA Proposals. Fisheries Forum Coalition, pp69.
- Newell, R., Sanchirico, J., Kerr, S. 2005. Fishing Quota Markets. *Journal of Environmental Economics and Management*, 49 (3), 437-462.