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Private rights, public benefits: Industry-driven seabed protection

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ABSTRACT

New Zealand has a large exclusive economic zone (EEZ) that contains a variety of marine habitats and commercially-important species. The commercial fishing industry operating within New Zealand's EEZ is of significant value to the economy and fisheries resources are managed through the extensive use of Individual Transferable Quotas (ITQs). One of the benefits of ITQs has been to better align some of the private incentives of quota owners with the public interest. These incentives contributed to an initiative proposed by the fishing industry to close large areas of New Zealand's EEZ to protect the seabed from trawling. These closed areas are termed benthic protection areas (BPAs) and protect the benthic biodiversity of about 1.1 million square kilometres of seabed—approximately 30% of New Zealand's EEZ. A significant proportion of New Zealand's known seamounts and active hydrothermal vents are protected by these closed areas. We describe and discuss the criteria used to select BPAs and some of the criticism of this marine protection initiative. We argue that the assignment of strong property rights in fishing resources was an important precondition to an industry initiative that has a significant public benefit. Where private and public interests are well aligned, government can adopt an enabling and facilitation role, ceding direct control of processes in order to get the results the align with the public interest.

1. Introduction

In November 2007, New Zealand closed over 1.1 million square kilometres of its EEZ to bottom trawling and dredging (Fig. 1). This protection initiative is unique for a number of reasons; not only is it large—perhaps the single largest marine protection initiative in any nation's EEZ—but most notably it was proposed and developed by the commercial fishing industry, which is traditionally seen as opposed to marine protection using spatial tools. In this paper we set out the background to this unique marine protection initiative, discuss its form, provide some analysis of the initiative and explore the factors that made it possible.

The focus of much of the literature on property rights in fisheries is on their effect on target stock sustainability, on economic efficiency, or on social impact [1,2]. This paper addresses a largely unexamined effect. It provides a case study on how the allocation of rights can draw together the interests of private quota holders and those of the general public to address the environmental concern about bottom trawling. As property rights in fisheries are typically expressed as a unit of production (such as a right to a percentage of the overall allowable harvest) or as a unit of an input (such as a right to deploy a trap), the broader environmental effects of fishing are usually considered to be externalised from the fishing right.

1.1. Geo-political context

New Zealand is a small island nation with a land mass of about 270,000 km^2 and a coastline of about 15,000 km. By contrast, New Zealand's marine area is vast, primarily due to the fortuitous location of a few sub-tropical and sub-Antarctic island groups that lie between 500–800 km from the mainland (Fig. 1). The territorial sea and EEZ cover a little over 4 million km^2 and extend across a range of more than 30° of both latitude and longitude. The marine territory includes large, relatively shallow continental plateaux, volcanic-related arcs and deep ocean basins.

While the bathymetry may be complex, the political landscape is relatively simple. New Zealand has only one level of government, a single chamber of Parliament, and no disputed international boundaries. This simplicity provides for a relatively uncomplicated environment within which to progress marine protection initiatives and, together with the small size of New

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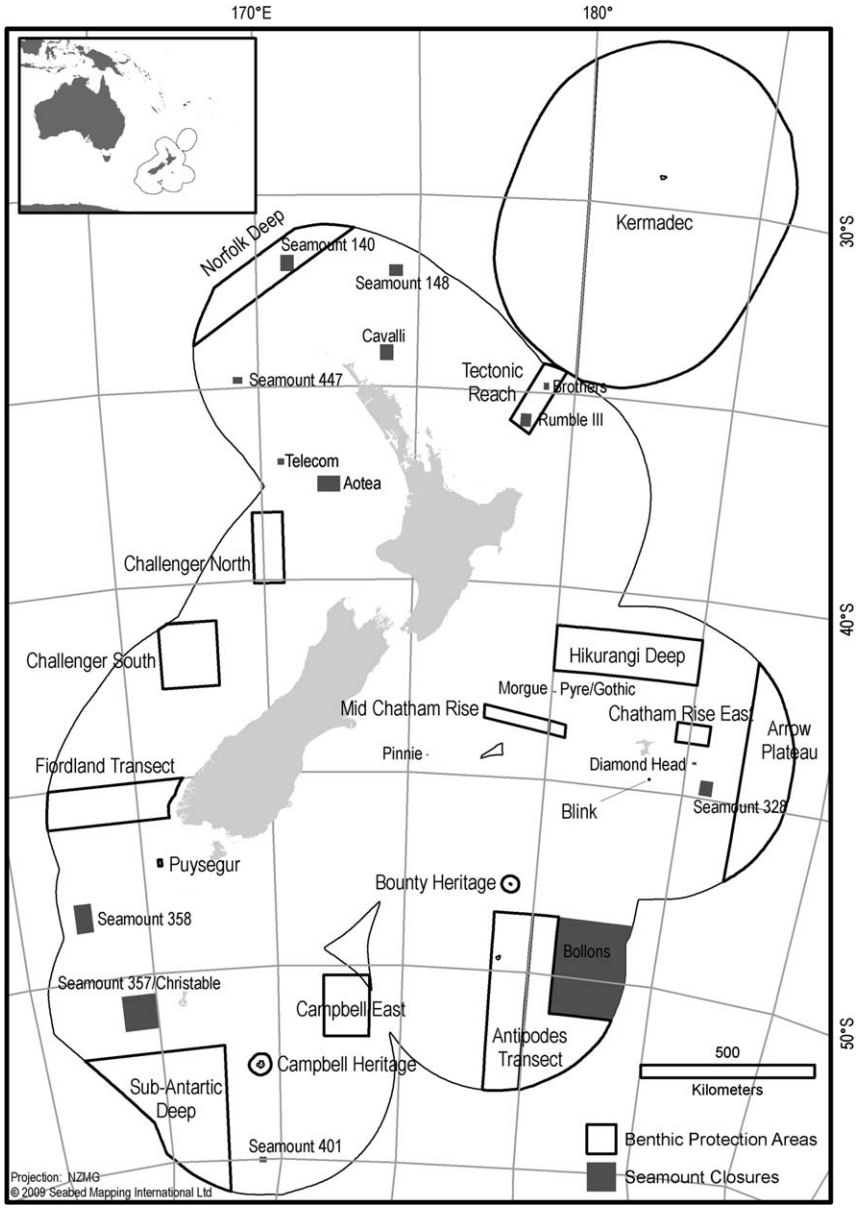

Fig. 1. Location of benthic protection areas (BPAs) and seamount closures in New Zealand's EEZ.

Zealand, provides the opportunity for direct access by officials and stakeholders to senior government Ministers.

1.2. Fishing activity and management

New Zealand's seafood industry harvests about 570,000 t from wild fisheries each year and the export value of this harvest ranges from NZD$1.0 to NZD$1.4 billion per annum. Approximately 90% by value of New Zealand's seafood harvest is exported and fishing is a critical component to New Zealand's economy. Seafood consistently ranks as New Zealand's fourth or fifth largest export earner and the industry is an important source of direct and indirect employment and economic activity domestically.

There are about 130 species targeted commercially in New Zealand waters. However, 10 deepwater species make up about 70% by volume of New Zealand's total catch. Many countries manage fisheries using input controls and/or competitive catch limits across a fishery. While the use of output controls, which may include some elements of individual ownership of outputs, is becoming increasingly common, New Zealand has adopted this approach for almost all commercial fisheries, and all the key deepwater species are managed using Individual Transferable Quotas (ITQ). This ITQ, expressed as a percentage of the total allowable commercial catch, is allocated for each fish stock in New Zealand's Quota Management System (QMS).[2] This gives the quota owner a right to harvest a set percentage of the available catch; the owner can also use the open market to buy and sell quota within government-established quota concentration limits, and can similarly freely trade the annual harvest right, separate from the long-term quota right [3].

One of the results of New Zealand's ITQ system has been to improve the alignment of many of the private interests held by

[2] New Zealand's management framework is generally referred to as the QMS; however, ITQs are only one part of a larger range of input and output controls used to manage fisheries.

quota owners with the interests of the public. The extent to which these interests are aligned varies by issue and among holders of the ITQ. ITQ has traditionally been seen to provide incentives for quota owners to ensure the sustainability of stocks in order to preserve their potential for ongoing revenue from the fishery. However, incentives are less well aligned for some externalities such as environmental effects of fishing; the effects of bottom trawling on the seabed being one such example.

Despite weaker incentives operating to address the environmental effects of fishing, New Zealand has created the conditions in the deepwater, where rights are best defined, where significant progress has now been made to address an important environmental issue without government compulsion. As stated by Kooiman, "One of the most important tasks of governing is to create conditions [in which] societal problems are able to solve themselves" [4]. Following this view, the government works alongside the deepwater industry in a number of areas to provide industry with the rights and tools to internally resolve issues that are of broader public interest. The establishment of benthic protection areas (BPAs) are a demonstrable outcome of this policy approach.

1.3. Legislative and policy context

The primary statute for establishing marine protection in New Zealand is the Marine Reserves Act 1971. However, under the Marine Reserves Act, marine reserves can only be established within the territorial sea so cannot be used to protect most deepwater benthic habitats. Consequently, marine protection in the EEZ is provided using other legislation and associated policies.

Fishing in New Zealand is managed under the Fisheries Act 1996 (the Act). The purpose of the Act is to provide for the utilisation of fisheries resources while ensuring sustainability. Sustainability includes avoiding, remedying or mitigating any adverse effects of fishing on the aquatic environment.[3] What constitutes an "adverse effect" is not defined by the Act; however, "effect" is broadly defined and includes direct, indirect, temporary, cumulative, past, present and future effects. The result of this construct is to differentiate between "impacts" or "effects" and "adverse effects". The former are permissible; however, when they become too pervasive or severe, management action is required to avoid, remedy or mitigate their effect. The point at which an effect becomes an *adverse* effect is determined by the Minister on the advice of officials—after public consultation—and in the context of the Act.

As outlined above, one of the management strategies available is to *avoid* adverse effects—as a matter of logic, adverse effects avoided can no longer be remedied or mitigated. We believe that an avoidance strategy is preferable to protect deepwater benthic habitats because of the relative prevalence of biota that is fragile, slow growing and has long regeneration times. Given the inherent sensitivity of some species, avoiding any effect in a portion of sensitive areas is preferable to allowing some lesser impact over the entire area.

Several policy documents also guide marine protection. The New Zealand Biodiversity Strategy [5] contains objectives to protect 10% of New Zealand's marine environment by 2010 and to develop and implement a Marine Protected Areas Policy (MPA Policy). The MPA Policy was subsequently developed and launched with the objective to protect marine biodiversity by establishing a network of MPAs that is comprehensive and representative of New Zealand's marine habitats and ecosystems [6].

The MPA Policy approach is to use primarily the Marine Reserves Act and Fisheries Act, which can be used in the EEZ, to provide targeted protection to a full range of habitats and ecosystems. This is based on a marine classification system and recommendations for protection made to Ministers by fora composed of customary, commercial and recreational fishers and environmental groups.

1.4. Marine protection prior to 2007

In the absence of any overarching MPA Policy, marine protection in New Zealand prior to 2007 had been sporadic and disconnected. Marine reserves provide marine protection within the territorial sea in a range of habitats. Although marine reserves provide a higher level of protection by prohibiting all extractive activities, most tend to be small and establishing them has usually been contentious. New Zealand's 34 marine reserves protect about 7.6% of New Zealand's territorial sea; however, 99% of this is in two marine reserves in the territorial seas around offshore island groups in the far north and far south of New Zealand's EEZ.

Many restrictions on fishing have also been implemented under the current and previous Fisheries Acts. Although these restrictions were primarily for the purpose of managing fisheries rather than marine protection, most afforded some degree of protection to the marine environment. The most significant protection initiative under the Fisheries Act came in 2001 when 18 areas in the EEZ were closed to all trawling to protect seamounts and their associated biota (*c.* 81,000 km^2). These closures protect 25 underwater topographic features (UTFs), 12 of which are seamounts.[4] These closures are known colloquially as "seamount closures" (Fig. 1).

2. The proposal to establish benthic protection areas

2.1. Background

In most countries, the commercial fishing industry is divided by species, area and/or gear type. The lack of well-defined rights across the full portfolio of target and bycatch species tends to foster competition among fishers rather than providing an environment conducive to the formation of collectives and co-operation.

The allocation of rights in New Zealand has made a significant contribution to the formation of collectives (groups of quota owners) that co-operate on issues of common concern. For deepwater fisheries, the Deepwater Group Ltd. (DWG) represents approximately 95% of the quota owned in New Zealand's deepwater and middle-depths fisheries. The DWG brings quota owners together to participate in the management of deepwater fisheries and, by virtue of its super-majority of quota holdings, it has a strong mandate to act. The DWG also provides a single, clearly-defined contact point for discussions between government and quota owners.

These attributes, particularly since 2005 have led to a relationship between the deepwater quota owners and the government that is generally constructive and co-operative. In the absence of such a relationship, government's role is weighted more toward regulating and enforcing breaches of regulations. This approach risks creating a fishing industry that is less co-operative and more combative; this makes developing and implementing good policy more difficult. It also does not support

[3] Fisheries Act 1996, s 8.

[4] The term seamount is defined as UTFs of >1000 m elevation.

the goal of the commercial fishing industry taking responsibility for and managing environmental externalities.

The legislative and policy context described above leaves considerable flexibility for management action. What constitutes "adverse effect" is open to interpretation and debate. The policy objective to protect 10% of the marine environment by 2010 is also somewhat arbitrary. Despite the subjective nature of these legislative and policy objectives, the DWG approached government in late 2005 with a marine protection initiative to address the environmental concerns over bottom trawling.

2.2. The benthic protection initiative

The benthic protection initiative proposed to establish BPAs that would set aside a broadly representative sample of benthic habitats, in essentially pristine condition, to avoid any future adverse effects of fishing on the seabed. This would preserve a large portion of New Zealand's marine environment while allowing fishing to continue in other areas or in a way that did not modify benthic habitats within the BPAs. By setting aside large areas of the EEZ where fishing could have no effect on the benthos, adverse effects are more likely to be avoided while other areas remain available for fishing.

The initial BPA proposal was to protect 14 areas primarily in the EEZ; the total closed area would be equivalent to 31% of New Zealand's EEZ. As part of the initial proposal the fishing industry sought, but ultimately did not obtain, an agreement from government that establishing BPAs was sufficient to fulfil the legislative obligation to avoid, remedy or mitigate any adverse effects of fishing on the benthic environment. Had that been agreed to, no future area closures would be required either to meet legislative obligations under the Fisheries Act or to protect biodiversity under the MPA Policy.

In early 2006, after receiving industry's BPA proposal, the Minister of Fisheries requested that the DWG amend its proposal to increase its representativeness. In response, the BPA proposal was amended to ensure greater representation of depth, marine classification classes and to ensure closures were located to encompass sufficient latitudinal and longitudinal variation.

The Ministry of Fisheries then consulted the New Zealand public on this revised proposal on behalf of industry. Following consultation, a number of further amendments were made to the BPA proposal; most significant was the addition of three new BPAs. These new areas totalled 13,887 km^2, incorporated an additional 10 active hydrothermal vents, and 35 UTFs, which included 10 seamounts.

The fishing industry also sought some relief from research costs. In New Zealand, the costs of conducting research to avoid, remedy or mitigate a risk to, or adverse effect on, the aquatic environment or the biological diversity of the aquatic environment must, so far as practicable, be attributed to the persons who cause the risk or adverse effect.[5] Simply put, the cost of research is recovered from quota owners. In contrast, the cost of research that is provided in the general public interest is not recovered from quota owners. The fishing industry's view was that if BPAs avoided adverse effects on the aquatic environment, the fishing industry could no longer be levied for research into the effects of fishing on deepwater habitats.

In recognition of the contribution that BPAs would make to marine protection, the government agreed that any research relating to the potential effects of bottom trawling on the benthic environment or its biodiversity should be two thirds Crown-funded and one third industry-funded. The amendment to the Cost Recovery Rules also limited the amount of research funding the Crown will recover from industry for benthic research in the EEZ.

[5] Fisheries Act 1996, s 262.

3. Analysis of the BPA initiative

Benthic protection areas were selected on the basis of four key selection criteria: BPAs were to be large, relatively unfished, have simple boundaries, and be broadly representative of the marine environment. These criteria are briefly discussed below.

3.1. Large

Benthic protection areas were designed to be big, both as individual parcels and cumulatively. Although two of the BPAs are small (0.3 and 187 km^2) the average size of BPAs is 66,800 km^2. Taken together, they protect approximately 1.13 million km^2 of New Zealand's seabed.

To put this in perspective, there are only about 19 countries whose entire EEZ is bigger than the area protected in the BPA network [7], and BPAs appear to be the largest single marine conservation initiative ever implemented within any nation's territorial sea or EEZ to date (Table 1).

3.2. Relatively unfished

The Ministry of Fisheries collects information from all commercial vessels. In deepwater fisheries this information specifies vessel type, fishing location and duration, water depth, species type, species weight and fishing method. These data are the best information available about where trawling has occurred, and they were used to estimate the location and extent of trawling within New Zealand's EEZ [8].

This analysis suggested that between 1989 and 2006, 8.5% of New Zealand's EEZ was directly affected by trawling in deepwater and middle depths fisheries and the main fishing grounds are located in relatively few areas (Fig. 2) [8]. This estimate is very similar to another produced by the National Institute of Water and Atmospheric Research (NIWA) using a different methodology [9]. These data were used to help design a network of closures that had minimal impact on current fishing activity.

3.3. Simple boundaries

Simple boundaries promote a straightforward and accurate legal description, which in turn makes it easier for fishers to determine when they are in a BPA and assist in compliance monitoring. In most cases, BPAs follow latitude and longitude lines, or the edge of New Zealand's EEZ.

Table 1
Largest protected areas within national jurisdictions.

Protected area	Size (km^2)
Benthic protection areas (New Zealand)	1,134,089
Alaskan essential fish habitats (US)	1,002,389
Bering sea habitat conservation area (US)	445,887
Phoenix islands protected area (Kiribati)	410,500
Papahanaumokuakea marine national monument (US)	362,000
Great barrier reef marine park (Australia)	344,400

Data are modified from MPA News vol. 9 No 8 (March 2008).

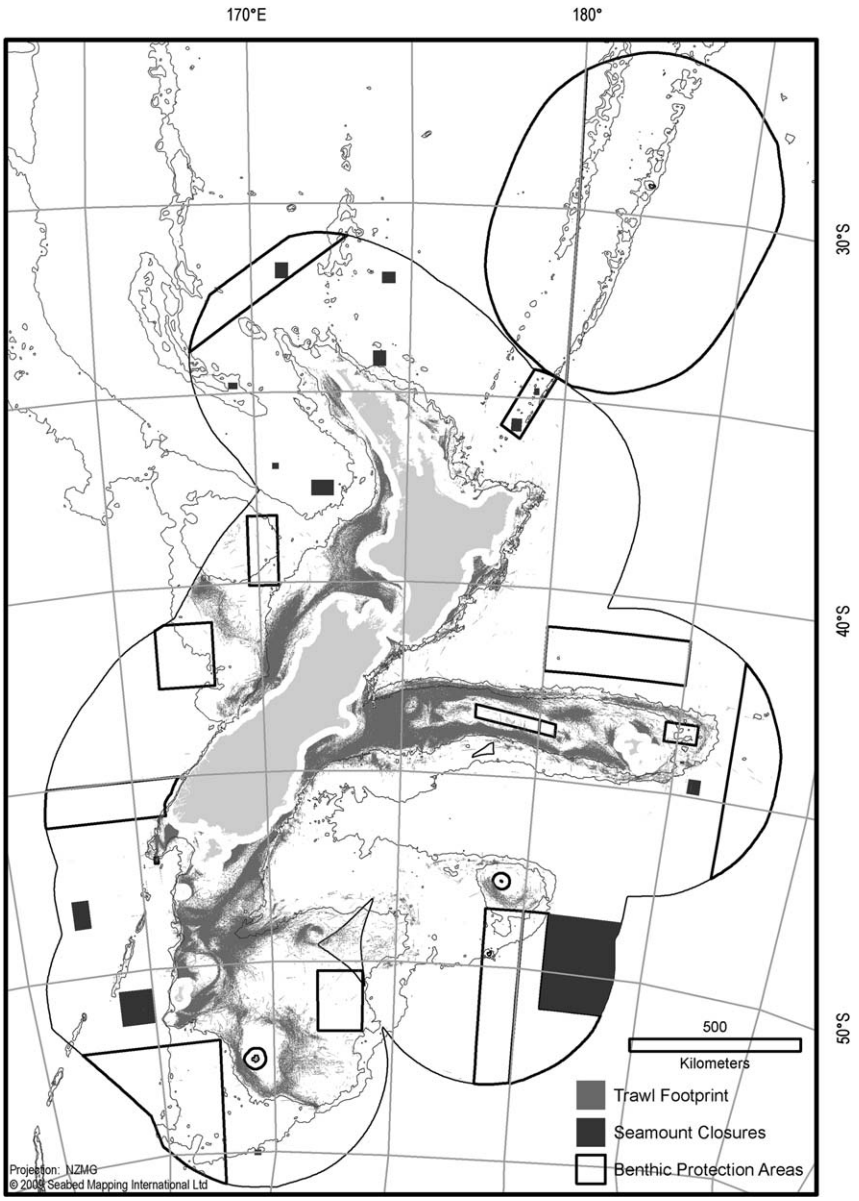

Fig. 2. The estimated trawl footprint of New Zealand's deepwater fisheries between 1989 and 2006. The depth contours represent 750 and 1500 m.

3.4. Representative of the marine environment

The BPAs are spread relatively evenly by latitude and longitude ranging from approximately 26°S to 55°S and 161°E to 171°W. Industry selected BPAs to ensure they were representative of the Marine Environment Classification 2005 (MEC).

The MEC was developed by NIWA with public funding [10]. The aim of the MEC was to provide a spatial framework to facilitate the conservation and management of indigenous marine biodiversity by subdividing the marine environment into units with similar environmental characteristics.

Because of a lack of consistent biological data, the MEC uses predominantly physical variables (for example, depth, sea surface temperature, seabed slope and annual solar radiation) to create proxies for marine environments and groups them into broadly similar areas, called "environment classes". The MEC is not a habitat map: while the MEC currently does not predict the biota that is present in a specific area, the pattern of physical variables provides an indication of possible broad-scale environment types that are likely to influence the biota associated with a particular environment class. An important assumption is that areas within the same environment class will be expected to have more in common with each other than with areas falling into other classes.

The MEC describes 11 coastal and 9 oceanic classes. The BPAs were designed to protect oceanic classes, which are predominantly located in the EEZ (Fig. 3). At least 10% of all nine oceanic MEC classes is protected (Table 2) and the percentage of each oceanic MEC class protected by BPAs ranges from 11% to 86%. The exception to the 10% criterion is Class 55, where only 3% is protected; however, about one-third of this particular class falls within the Territorial Sea and most of the bottom trawling in that area is for coastal species, rather than deepwater species.

BPAs were also selected to protect the benthic habitat in three depth classes: 200–750, 750–1500 and >1500 m. Protection is provided for approximately 11% of the EEZ between 200–750 m in depth, 20% for the depth range between 750–1500 m and 38% for depths >1500 m (Table 3).

BPAs are primarily a deep water protection initiative: protected areas are outside the 12 nautical mile territorial sea,

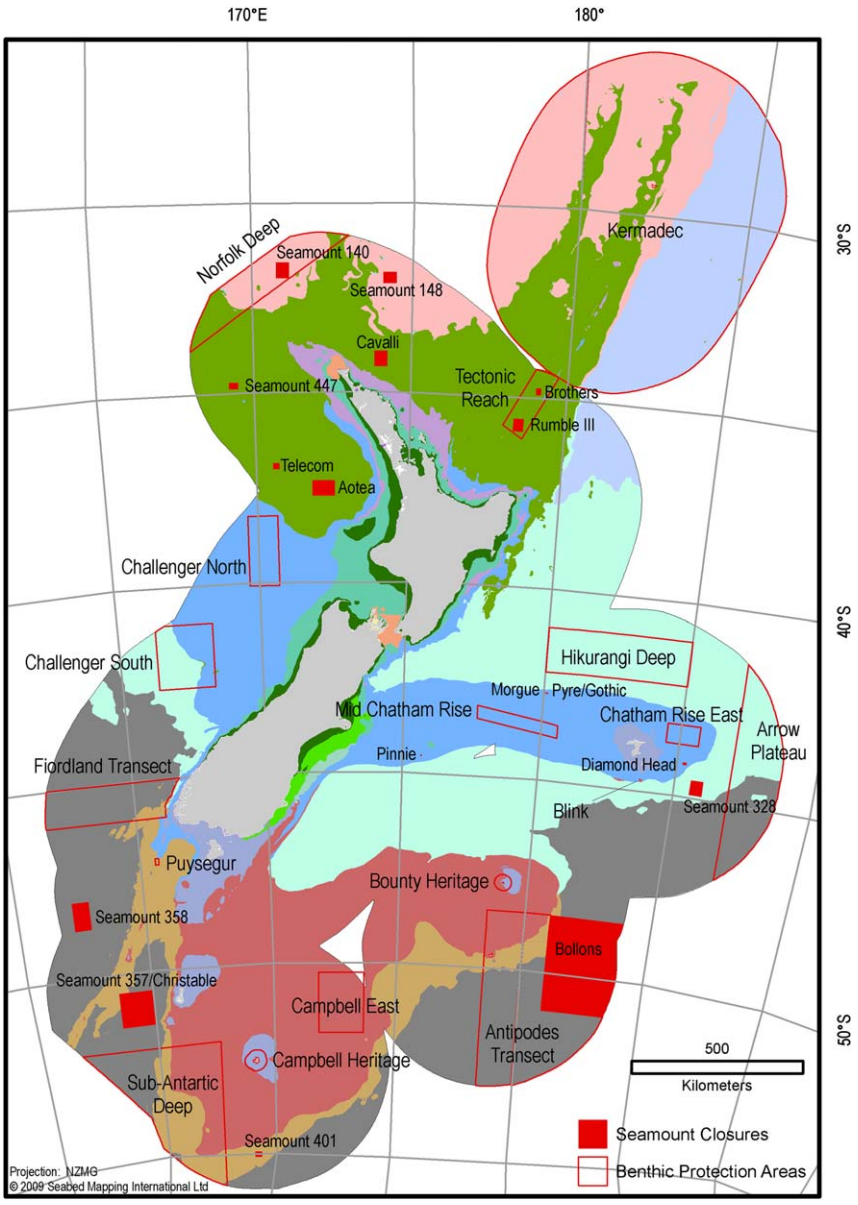

Fig. 3. Location of the seamount closures (filled red boxes) and benthic protection areas (open red boxes) overlaid with the Marine Environment Classification 2005. (For interpretation of the references to the color in this figure legend, the reader is referred to the web version of this article.)

Table 2
Area of each Oceanic MEC class protected by BPAs.

MEC Class	1	9	22	47	55	63	127	178	204
Area in EEZ (km^2)	355,193	260,793	608,902	711,705	28,192	418,523	694,311	504,243	210,021
Area in BPA (km^2)	279,965	224,560	172,215	105,881	894	45,489	173,323	75,507	53,231
	79%	86%	28%	15%	3%	11%	25%	15%	25%

and focused on waters deeper than 200 m. That said, protection was provided by four BPAs to areas shallower than 200 m, and this shallower depth range is reported in Table 3 for completeness.

3.5. Biodiversity protection and vulnerable marine ecosystems

The FAO Guidelines for the Management of Deep Sea Fisheries describe vulnerable marine ecosystems (VMEs) as being rare or unique; functionally significant; fragile; slow to recover and structurally complex [11]. The FAO Guidelines also distinguish between the biota associated with features like seamounts and hydrothermal vents, such as cold water corals and sponge fields that are VMEs, and the physical features themselves, that are not. VMEs have been identified by the United Nations as a priority for protection from significant adverse impacts of bottom fishing [12].

The focus of BPAs was not specifically on protecting VMEs, but rather protecting the benthic environment generally. However, assuming that protecting seamounts and hydrothermal vents also

Table 3
Depth ranges protected in the seamount closures and BPAs.

Depth Range	Within EEZ		Within seamount closures		Within BPAs	
	Area (km^2)	(%) of EEZ	Area (km^2)	(%) of EEZ	Area (km^2)	(%) of EEZ
<200 m	120,168	3	0	N/A	4,087	3
200–750 m	538,311	14	166	0	57,437	11
750–1500 m	705,073	18	6,872	1	139,031	20
>1500 m	2,542,512	65	74,053	3	933,534	38
Totals	3,906,064	100	81,091	2	1,134,089	29

Table 4
Number and percentages of known underwater topographic features (UTFs), seamounts and active hydrothermal vents protected by the seamount closures and BPAs.

	Within EEZ	Previous seamount closures	BPAs	Total
UTFs (including seamounts)	522	25 (5%)	122 (23%)	144 (28%)
Seamounts (>1000 m)	98	13 (13%)	41 (42%)	51 (52%)
Active hydrothermal vents	26	6 (23%)	23 (88%)	23 (88%)

Note that some features appear in both the current seamount closures and BPAs and have been included in both columns; as such totals are not the sum of both columns but reflect the total protection afforded by both measures.

protects the associated biota, the number of VMEs protected provides some indication of the biological value of the areas within BPAs. The BPAs, when combined with the existing seamount closures, protect 28% of known UTFs, 52% of known seamounts and 88% of known active hydrothermal vents within the EEZ (Table 4).

The biodiversity value of BPAs can be further assessed by reference to known biodiversity "hotspots". In 2004, WWF–New Zealand published an independent, scientific assessment of New Zealand's biodiversity [13]. Twenty-two marine scientists met at an expert workshop to identify, describe, and map key biodiversity areas and features, including benthic biodiversity. The report identified 15 biodiversity hotspots that have more than half their area in the EEZ. Although several of the hotspots are small, BPAs cover nine of them, and of these, six are 10% or more protected (Fig. 4). Our analysis concludes that 87% of WWF–New Zealand's biodiversity "hotspots" are either protected by BPAs or have never been impacted by trawl gear [14].

4. Discussion

Initial public reaction to BPAs was mixed. Many people were surprised that a proposal of this size and scope came from the fishing industry and many supported the initiative. However, there was a small but vocal opposition from those with an interest in marine conservation; their primary concerns are outlined below.

4.1. Protecting pristine unfished areas

Some considered that if the marine protection initiative did not cover existing fishing areas (by prohibiting trawling in some of the areas where it currently occurs), then the protected areas had little value. The argument is that there is nothing to protect these areas from—so it has comparatively little preservation value. In response we emphasise that the BPA initiative sought to *avoid* (as opposed to remedy or mitigate) the adverse effects of fishing by setting aside large areas of the EEZ.

Unfished areas were selected primarily for two reasons. First, areas that are largely unfished have been subject to minimal effect from bottom-trawl gear. These areas should be in relatively pristine condition and should have a higher biodiversity value than similar habitats that have been exposed to trawling—as such they are good candidates for protection.

Second, it makes sense to provide marine protection in a manner that allows commercial fishing operations to continue. If the best available information suggests that a particular habitat type can be protected in either areas that are fished or in areas that are unfished, then as a matter of design, and as a policy preference to enable economic activity within environmental limits, the preference should be to protect the unfished area. In other words, fishing need not necessarily be constrained to provide adequate protection to that habitat: the focus must be on the outcome of habitat protection, and whether the management measures achieve this or not. This approach is consistent with government's MPA Policy which states that "Adverse impacts on existing users of the marine environment should be minimised in establishing MPAs." [6] It is also prudent to provide protection to marine habitats which may be very steep or deep even if current technology has yet to make their exploitation economically or technically feasible.

4.2. Targeted benthic protection

Another source of discontent was that BPAs allow other fishing methods to occur in the waters above the seabed. This was said to compromise the integrity of the ecosystem and did not recognise the connectivity between the seabed and the waters above.

As a matter of good public policy fishing should never risk the integrity of the ecosystem, regardless of whether it occurs near or above the seabed. The Fisheries Act requires that all species subject to the QMS be managed to ensure that stocks are maintained at or above a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks. Well-managed fisheries in the waters above any BPA should not compromise the integrity of the fished stock or the components of the ecosystem that lie below the fished stocks.

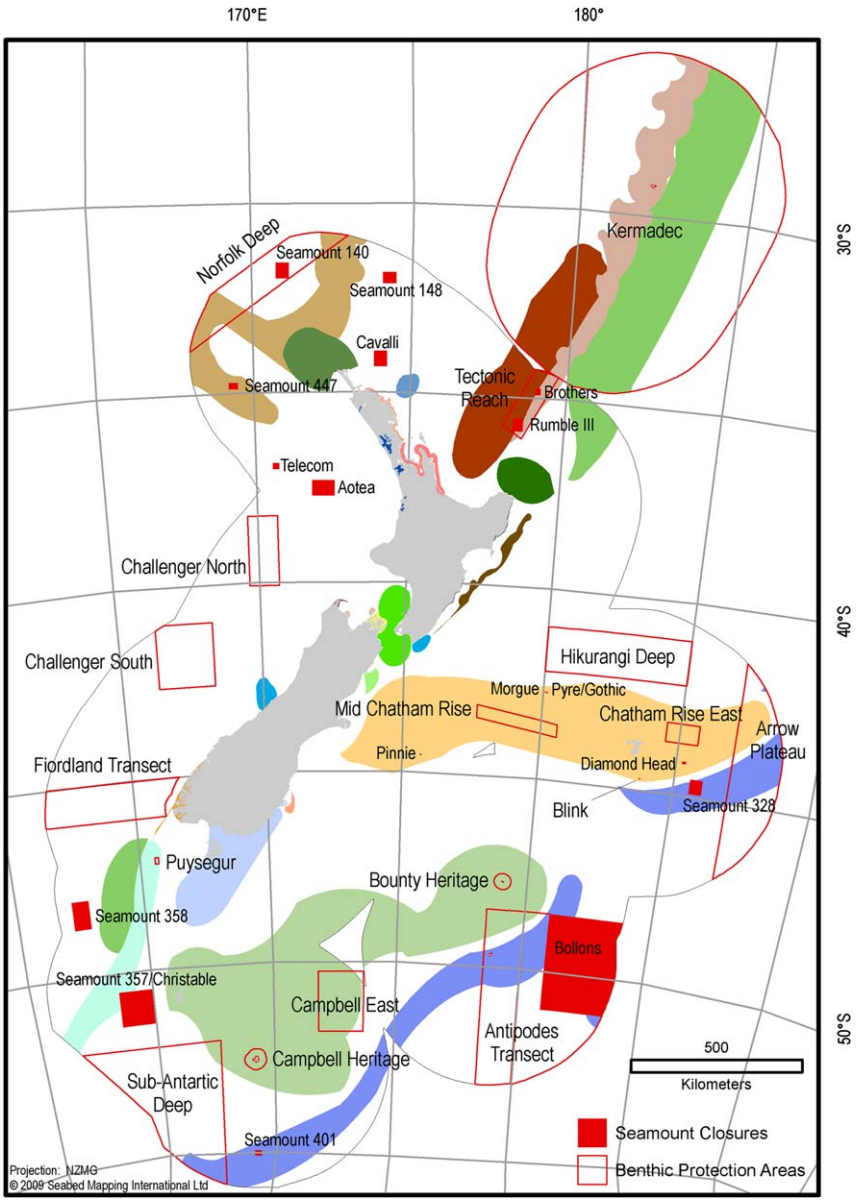

Fig. 4. Location of BPAs in relation to biodiversity hotspots identified by WWF–New Zealand.

The relationship of pelagic fish with the benthic environment is difficult to assess. Some insight is available from an expert workshop of fisheries biologists, marine ecologists, MPA managers and recreational fishers convened by NOAA's National MPA Center to consider when recreational pelagic fishing was compatible with the conservation of benthic communities [15]. The workshop considered that the benthic–pelagic linkages were weak in waters deeper that 100 m and recreational fishing in pelagic waters could be compatible with benthic conservation in these deeper areas, particularly in open ocean or deep shelf areas (depending on the specific location).

That said, BPAs are not meant to protect fish swimming in the waters above the seabed. BPAs protect those plants and animals (and their habitat structure) that live in or on the seabed or that have a direct relationship with it. To enforce this approach, any trawling within a BPA is subject to tight controls under the Fisheries (Benthic Protection Areas) Regulations 2007 to ensure that there is an extremely low risk of any fishing gear touching the seabed.

Under the Regulations, midwater trawling can only occur in a BPA if two government observers (paid for by industry) are onboard, and if a specialised electronic net monitoring system (ENMS) is in place onboard the vessel. The ENMS must continuously record the depth of the ground rope and seabed; the date and time; the latitude and longitude of the vessel; and any other information that may be required. The use of ENMS ensures the trawl gear does not approach or impact on the seabed.

For greater certainty, and recognising that fishing gear may not be perfectly controlled by the vessel's equipment, the Regulations established upper and lower buffer zones. The lower buffer zone extends from the seabed up to 50 m above the seabed. Any entry by trawl gear into this lower buffer zone is considered an impact on the seabed and the penalty is a fine of up to NZD$100,000 and the presumptive forfeiture of the vessel. The upper buffer zone extends above the lower buffer zone from 50 m above the seabed to 100 m above the seabed. Entry by trawl gear into the upper buffer zone is subject to a fine of up to NZD$20,000. The severity

of these offences is such that vessels will not allow trawl gear to get close to the seabed.[6]

4.3. Representative BPAs

The most vigorous debate in the public consultation process concerned the extent to which BPAs protect a representative sample of the benthic environment. At issue was whether New Zealand had, in fact, a useable classification system that was appropriate for a habitat protection selection process. As discussed above, the MEC was used for two reasons. First, the government funded the development of the MEC for the purpose of providing a classification to conserve and manage marine biodiversity—and this is precisely what it was used for. Second, the MEC was launched only six months before the BPA proposal was put to government and, as such, it constituted the best marine classification available. However, we note that the MEC has some shortcomings. Again, as described above, it only provides an *indication* of *possible* broad-scale environment types that are *likely* to influence the biota associated with a particular environment class; it is not a fine-scale tool, nor is it a classification of actual biological assemblages. Because the information for a direct habitat classification did not exist, these physical proxies were employed.

These potential limitations were addressed in several ways when designing the BPA network. First, the areas selected were large. The protection of large areas ensures that greater variation within each MEC class is represented in a BPA. To ensure further variation, a sample of each MEC class was protected by at least two different BPAs and these BPAs were spread between the eastern and the western side of New Zealand. This further increased the chance that any variation within MEC classes was protected within BPAs. While this does not prove representation of biota, it increases the likelihood that this has occurred.

Some public feedback also suggested that BPAs were of low conservation value. Some of this criticism was based on an analysis of BPAs conducted by NIWA [16,17]. This analysis used the distribution of 122 fish species to assess the conservation value of BPAs. The authors concluded that BPAs had little ''conservation value'' based on the incongruence of BPAs and fish distribution. Two observations are warranted about the actual informative power of this conclusion. First, a number of the 122 fish species used in the initial analysis have little association with benthic habitat in the EEZ (e.g. blue cod, kahawai and kingfish). The number of species used in a subsequent analysis was reduced to 96 although the species included are not specified [17]. Second, BPAs were not implemented to protect fish species, although those species with a close association with the seabed are afforded protection. This point has been adequately made above, the only addition to the argument is that New Zealand's QMS, used to manage fish stocks, does not generally rely on spatial tools. As such, it seems unreasonable to judge the effectiveness of BPAs against a criterion that they never intended to meet. Other management approaches are employed to ensure the sustainability of these species.

The BPA initiative is not a perfect solution to the complicated problem of managing human impacts on the marine environment. However, BPAs do provide a comprehensive solution to a significant component of the problem: the protection of pristine benthic habitats. The extent to which the BPAs are representative of the benthic environment is uncertain—and ultimately how much protection is required is a social judgement that can be informed, but not dictated, by science. Marine protection and fisheries management are not problems that have a single solution; there are many factors at play that require consideration. Economics, law and politics are central considerations that will often modify a scientifically-optimal solution.

4.4. Process

Some of the opposition to BPAs was rooted in its origins: that this proposal was initiated by the commercial fishing industry. Some would consider that no valuable and comprehensive marine protection initiative that restricts access to the marine environment could come from the fishing industry. We argue that the source of the proposal is secondary—the value of any proposal should be judged on its content rather than its source.

Allied to this criticism is the perception that the BPA initiative was an agreement reached behind closed doors between government and the commercial fishing industry without input from other stakeholder groups. While it is true that the BPA initiative does constitute an agreement between government and the commercial fishing industry, consultation was undertaken and some significant changes to the initial proposal were made on the basis of feedback received from the public. That said, the fully-fledged proposal was presented for comment, rather than developing a proposal from the ground-up with a range of stakeholders.

The process to implement BPAs did not follow the process to establish marine protected areas set out in the MPA Policy. In recognition of the contribution that BPAs make to marine protection in the EEZ, government agreed that until 2013 the implementation of the MPA Policy would focus on the Territorial Sea. However, the government reserved the right to make additional closures in the EEZ for the purpose of avoiding, remedying or mitigating any adverse effects of bottom trawling on, or maintaining biodiversity of, the benthic environment. The government could make additions for these purposes, providing significant information became available that materially affected whether legislative obligations or government policy objectives were being met.

The impact of delaying the MPA Policy in the EEZ is unlikely to be significant. At the time of writing, since the MPA Policy was released in January 2006, no recommendations for new MPAs have been put to government by the fora charged with implementing the Policy. Formal statutory processes would follow any recommendations to government for new MPAs and in the past these processes have been very time consuming and contentious. These delays are indicative of the difficulty inherent in providing marine protection. In contrast, from its inception to enactment, the BPA initiative was completed in less than two years, including drafting and passing new regulations. The relatively uncomplicated governance in deepwater fisheries provided an excellent opportunity to make rapid and significant progress on marine protection in the deepwater.

5. Conclusions

The establishment of BPAs in New Zealand's EEZ is a significant achievement, and would have been more difficult and time-consuming without cooperation between industry and government. The designation of BPAs recognises that maximising value from the oceans requires that significant areas be set aside for marine protection just as there must also be areas set aside to allow for a profitable commercial fishing industry. It must also be accepted that some impacts will occur in those areas set aside for fishing.

[6] The Fisheries (Benthic Protection Areas) Regulations 2007 can be found at www.legislation.govt.nz and include all offences and penalties.

While the circumstances in New Zealand that provided the opportunity for this initiative are unique, there are lessons that can be applied from this experience. New Zealand's MPA Policy, like many other countries, promotes a broad, formal, bottom-up protection process. It seeks consensus among stakeholders about possible areas for future marine protection and may be better suited to nearshore areas where there are many stakeholders and divergent views to reconcile. However, when circumstances allow for faster, alternative approaches, such as occurred with the BPA initiative, a more top-down negotiated process can be used to contribute rapidly to protection and resource management goals. The speed of implementation, which then results in the ability to redouble efforts on protection initiatives elsewhere, is an attractive prospect.

With respect to BPAs, efforts can focus on areas of remaining uncertainty such as refining the marine classification. New Zealand now has the opportunity to embark on evidence-based conservation. As Sutherland et al. state, "the consequences of conservation actions are rarely documented" [18]. Efforts can now be channelled towards recording the consequences of BPAs by conducting research that improves the benthic classification system—which would better assesses the extent to which BPAs are representative of the marine environment. For those portions of BPAs or seamount closures that were formerly fished, research could document the recovery of benthic structures and species assemblages. Both of these areas are in fact currently being explored; with the BPA initiative concluded, the deepwater fishing industry and the government managers working alongside them can both focus their efforts on supporting this work rather than diverting attention to ongoing debates on what areas to close.

As such, we assert that the focus of marine protection initiatives should be as much on progress towards objectives as it is on the process to achieve them. There is little point rejecting a substantial protection initiative because the process used to establish it departs from the norm. Pragmatism and compromise are essential if real progress is to be made to achieve habitat and biodiversity protection objectives.

The BPA initiative anticipates the potential for marine habitats to be adversely affected by fishing activity in the future and as such it is difficult to demonstrate their immediate tangible benefits: they provide protection in the absence of an imminent or actual threat. Perhaps no threat would have ever occurred, and their pristine state would be protected by dint of their inaccessibility rather than by regulation. But history shows that this is a risky approach: resource exploitation progressively moves to areas and resources previously thought not to be economically viable or to be technically unavailable. Apart from BPAs having secured these areas for the future, as a defence against potential exploitation, their implementation means that focus can shift towards completing the network of habitat protection, if required, with complementary initiatives.

The BPA initiative also challenges the traditional notions of the respective roles of government and industry—not just in marine protection, but more generally in fisheries management or the regulation of natural resource use. An understanding of actions by individuals and groups of individuals with like motives is vital when designing management. Where the private interests of these individuals or groups align with the public interest, the emphasis of government's role can shift away from regulator, defender or enforcer toward that of facilitator and enabler. Where fisheries are relatively incentive-compatible, collective management and shared stewardship is possible.

The more incentives are internalised, the greater the industry's discretion and autonomy may become. The likely consequence is that the operating environment can be more nimble and business-like, improving the conditions for wealth creation. Fisheries policy most broadly should seek to accelerate or induce the transition towards "incentive-compatible" fisheries, where public and private incentives align, and then recognise thereafter that the role of government can be modified.

New Zealand's recent history of deepwater fisheries management has demonstrated the critical role that the definition of secure property rights over fish stocks has played in management success. The industry's active promotion of stock sustainability and improved economic efficiency were partial objectives of the QMS, and other reviews have evaluated these successes [1,2]. The experience of BPAs has shown that the public interest in broader environmental issues can also be actively promoted using these rights. The successful use of property rights as a base for positive action required government and industry to shift to a more collaborative approach, and government to recognise the potential benefits of ceding control of processes and instead adopt a truly enabling role.

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