

ATTACHED BLADDER KELP (KBB3G, KBB4G)

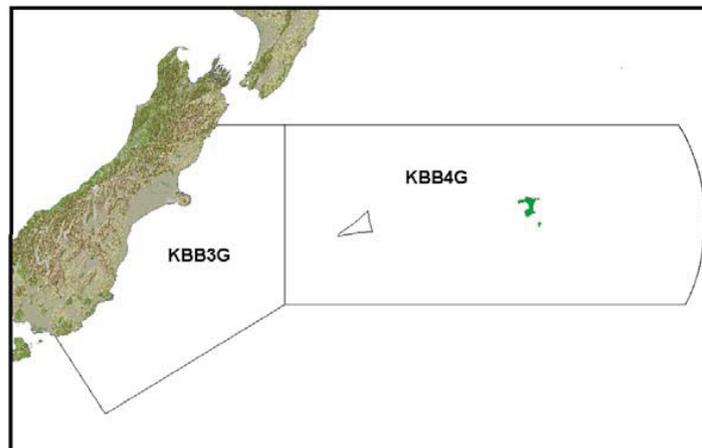


Figure 1: Quota Management Areas for attached bladder kelp

Executive Summary

- 1 Attached bladder kelp (*Macrocystis pyrifera*) will be introduced to the Quota Management System (QMS) in Fisheries Management Areas 3 (FMA3) and 4 (FMA4) on 1 October 2010. The Quota Management Areas (QMAs) for these stocks are defined as KBB3G and KBB4G, respectively (Figure 1). Prior to introduction you are required to set Total Allowable Catches (TACs), Total Allowable Commercial Catches (TACCs), sector allowances, deemed value rates, and consider additional harvest management measures.
- 2 MFish considers that the imposition of a TAC in isolation of any other management controls risks potential adverse effects from harvesting. The level of risk increases with higher TAC levels. In order to manage this risk MFish has consulted on a range of additional harvest management measures (i.e. Maximum cutting depth, Finer spatial scale reporting, Maximum canopy removal, Maximum canopy harvesting frequency, and Maximum canopy harvest width) that would complement the TAC.
- 3 MFish considers implementation of some of these additional harvest management measures would reduce the potential adverse effects from harvesting on localised areas and associated and/or dependent species, and enable greater utilisation. MFish's preferred option is to implement the Maximum cutting depth and Finer spatial scale reporting management measures to support the entry of KBB3G and KBB4G to the QMS.
- 4 If you choose to implement MFish's preferred additional harvest management measures, MFish recommends a TAC of 1239 t for KBB3G and 274 t KBB4G on the basis that:
 - a) Best available information suggests these stocks are considered to be near virgin biomass levels and are likely to sustain higher catch levels than present.
 - b) Bladder kelp forests are amongst the most productive marine communities in New Zealand, play a significant ecological role within the marine ecosystem and naturally experience large fluctuations in abundance both spatially and temporally. The additional management measures should help to protect their

function and provide additional information for future management.

- c) The recommended TACs are unlikely to have an adverse impact on the sustainability of the stocks in either QMA.
 - d) The recommended TACs would not have an adverse impact on customary and recreational utilisation opportunities as attached bladder kelp is generally not harvested by non-commercial fishers.
 - e) The recommended TACCs would provide industry with greater harvest opportunities from the resource to derive greater economic return, while reflecting the developing nature of the fishery.
 - f) There is strong support from the majority of submissions to proceed with a cautious proving up of the fishery levels until current robust stock assessment information becomes available and appropriate harvesting strategies can be developed.
- 5 However, given the uncertainty in current stock biomass, bladder kelp's natural variability, the importance of bladder kelp to the marine ecosystem, and the lack of information on potential adverse effects from harvesting, you may choose to proceed more cautiously and implement a lower TAC. Other options are included in this paper on this basis.
- 6 If you choose not to implement MFish's preferred additional harvest management measures, MFish recommends a TAC of either 41.2 or 18.2 t in KBB3G, and either 26.2 or 2.2 t in KBB4G due to uncertainty in the information highlighted above and the lack of additional management controls available to mitigate risk of potential adverse effects from harvesting.
- 7 MFish notes that because KBB3G and KBB4G are not yet in the QMS, there is no annual catch entitlement (ACE) price information currently available to determine market value. On this basis MFish recommends that you set:
- i) An annual deemed value rate of \$1.00 per kg and an interim deemed value rate of \$0.50 per kg;
- AND**
- ii) Standard differential deemed value rates in KBB3G and KBB4G but no overfishing thresholds at this time.
- 8 MFish considers these deemed value rates will provide incentive for fishers to balance catches with ACE and avoid harvesting on deemed values if landed prices increased during the fishing year. The rates can be adjusted in the future depending on new information received regarding port and ACE prices and catch versus TAC.

Catch Limits, Sector Allowances and Deemed Values

Introduction

- 9 MFish proposes a range of TACs and associated allowances for KBB3G and KBB4G, incorporating both the options originally consulted on in the Initial Position Paper (IPP) and the options developed based on new information received in submissions (Table 1, shaded options are new):

Table 1 TACs and sector allowances (tonnes, t) for your consideration for KBB3G and KBB4G

Stock		TAC (t)	Customary allowance (t)	Recreational allowance (t)	Other sources of mortality (t)	TACC (t)
KBB3G	Option 1	1866	0.1	0.1	1	1864.8
	Option 2	1238	0.1	0.1	1	1236.8
	Option 3	377	0.1	0.1	1	375.8
	Option 4	41.2	0.1	0.1	1	40
	Option 5	18.2	0.1	0.1	1	17
KBB4G	Option 1	411	0.1	0.1	1	409.8
	Option 2	274	0.1	0.1	1	272.8
	Option 3	26.2	0.1	0.1	1	25
	Option 4	2.2	0.1	0.1	1	1

- 10 MFish also proposes the following options for annual and interim deemed value rates:
- i) Annual deemed value rate of \$4.00 per kg, and an interim deemed value rate of \$2.00 per kg; **OR**
 - ii) Annual deed value of \$1.00 per kg and a interim deemed value of \$0.50 per kg (MFish preferred option);
- AND**
- iii) Set standard differential deemed value rates in KBB3G and KBB4G but no overfishing thresholds be set at this time.

Consultation

- 11 Your decisions on the proposed TACs, sector allowances and deemed values for KBB3G and KBB4G are made under s 13, 21 and 75A of the Fisheries Act 1996 ('the Act') and therefore the consultation requirements of s 12 apply. The IPP was released for 6 weeks of public consultation beginning on 4 March 2010 and was published on the MFish external website. The IPP was also sent to persons and organisations with an interest in review of fisheries' sustainability measures, and bladder kelp specifically; including tangata whenua, environmental, recreational and commercial stakeholders.

Submissions Received

- 12 MFish received thirty-two submissions on the IPP from:
- Mark Armstrong (Armstrong)
 - Chatham Islands Council (CIC)
 - Chatham Islands Enterprise Trust (CIET)
 - H N Daymond (Daymond)
 - Kotuku Daymond (K Daymond)

- Department of Conservation (DOC)
- East Otago Taiapure Management Committee (EOTMC)
- Forest & Bird
- Graham Harris (Harris)
- Dr. Christopher Hepburn (Hepburn)
- Ada Hough (Hough)
- Dr. Catriona Hurd, Dr. C. Hepburn, Chris Cornwall, Rebecca James, Daniel Pritchard, Derek Richards (Hurd et al.)
- Kāti Huirapa Rūnaka I Puketeraki (Puketeraki)
- Dr. Rebecca McLeod (McLeod)
- Dr. Wendy A. Nelson (Nelson)
- New Zealand Seafood Industry Council Ltd. (SeaFIC)
- NZ Rock Lobster Industry Council (NZRLIC)
- Nga Hapu O Te Uru Forum (NHOTU)
- Ngāi Tahu Seafood (Ngāi Tahu)
- Ocean Organics Ltd. (Ocean Organics)
- option4 and Hokianga Accord (option4)
- Pā Tangaroa Customary Fisheries Forum (Pā Tangaroa)
- Paua Industry Council Ltd. (PIC)
- PauaMAC4 Industry Association Inc. (PauaMAC4)
- Laura Robertson (Robertson)
- Sea-Right Investments Ltd. (Sea-Right)
- Seaweed Association of New Zealand Inc. (SANZ)
- Te Ohu Kaimoana Trustee Ltd. (Te Ohu)
- B J Thomas (BJ Thomas)
- Brian Thomas (Thomas)
- Wellington Recreational Marine Fishers' Association Inc. (WRMFA, endorsed by option4)
- Robert Win (Win)

Summary of Submissions

- 13 Twenty-four of the thirty-two submissions oppose any of the TAC options proposed for either KBB3G or KBB4G:
- a) Eight⁴ submissions strongly oppose any commercial harvest of attached bladder kelp, and a number of them request that a TAC or TACC of zero tonnes (t) be implemented in one or both QMAs. These submissions consider that bladder kelp plays a critical role in the coastal and inshore aquatic environment, and there are risks associated with commercial harvesting (e.g. loss of important habitat and food supply; disrupted nutrient cycling processes; increased coastal erosion; direct/indirect adverse effects on associated and/or dependent species).
 - b) Eight⁵ submissions consider that all of the TAC options presented were exceptionally, and unnecessarily, conservative in light of historical biomass information and geographic distribution. Some of these submissions proposed alternative TAC options. For KBB3G, Sea-Right proposes a TAC of 3000 t, while SeaFIC and Te Ohu suggest a TAC of 2000 – 4327 and 800 – 2000 t, respectively. CIC, CIET, Sea-Right and Te Ohu propose a TAC of 1000 t in KBB4G, while SeaFIC suggests a TAC of 1000 – 3000 t.

⁴ K Daymond, EOTMC, Forest & Bird, option4 (with support from Hokianga Accord), Puketeraki, NHOTU, Thomas, WRMFA

⁵ CIC, CIET, NZ RLIC, PauaMAC4, PIC, SeaFIC, Sea-Right, Te Ohu

- c) To support their proposals additional information was provided for assessment, including a research paper⁶ estimating biomass in one area of KBB3G, and satellite imagery of bladder kelp beds in KBB3G and KBB4G. The additional information has been assessed by the MFish Science team and incorporated, where appropriate, into revised assessments of stock status.
- d) Four submissions⁷ request that the setting of TACs be postponed until appropriate management strategies are developed to manage potential adverse effects of harvesting, and information is available to set TACs at an appropriate level that is viable for economic development.
- e) Four submissions⁸ did not indicate a preference for any of the proposed TAC options nor did they indicate an alternative. Hepburn recommends that you apply a cautious approach in setting TAC and acknowledge the fact that bladder kelp provides the base of many coastal fisheries and has important roles in coastal processes. Hepburn considers that high value fisheries that rely on kelp forest habitats could be compromised by a low value bladder kelp fishery. Ngāi Tahu recommends the TAC for KBB3G be set to provide for a gradual and careful proving-up of the fishery, taking into account the existing fisheries of customary and commercial importance (e.g. paua) and also the ecosystem functions of bladder kelp.

KBB3G

- 14 Two submissions [Ocean Organics, SANZ] support Option 1 in the IPP (TAC = 377 t), the highest level of utilisation proposed based on the largest estimated yield recorded in Akaroa Harbour.
- 15 Two submissions [DOC, Robertson] support Option 2 in the IPP (TAC = 41 t); a moderate level of utilisation, which is based on current permit allowances and precautionary expansion of the industry.
- 16 Five submissions [Hurd et al, McLeod, Nelson, option4, and Win] support Option 3 in the IPP (TAC = 18.2 t); the most conservative level of utilisation, which is based on average harvest under the current permit allowance over the last five years. option4's support for Option 3 with input controls is secondary to its first option of a TACC set at zero tonnes.

KBB4G

- 17 Two submissions [Ocean Organics, SANZ] support Option 1 in the IPP (TAC = 26.2 t); the highest level of utilisation proposed, which is based on current permit allowances.
- 18 Seven submissions [DOC, Hurd et al, McLeod, Nelson, option4⁹, Robertson, and Win] support Option 2 in the IPP (TAC = 2.2 t); a conservative level of utilisation that is based on the lack of exploitation despite available harvest allowances under the current permit regime.

⁶ Fyfe, J., Israel, S.A., Chong, A., Ismail, N., Hurd, C., and K. Probert. 1999. Mapping marine habitats in Otago, Southern New Zealand. *Geocarto International* 14(3): 17-28.

⁷ Daymond, Hough, Pā Tangaroa, BJ Thomas

⁸ Armstrong, Harris, Hepburn, Ngāi Tahu

⁹ option4 primarily support a TACC set at zero tonnes, but would support Option 2 with input controls.

- 19 Issues raised by submitters considered by MFish to be outside the immediate scope and intention of the IPP proposals can be found at the end of this document.

Fishery and stock status

- 20 This section provides a summary of information used to formulate the management options consulted on in the IPP, plus new material received during submissions (i.e. a research paper, and satellite/aerial images). The new material has been assessed by MFish and, where considered robust, used to revise the stock status summaries.

Biological characteristics of bladder kelp (Macrocystis pyrifera)

- 21 *Macrocystis pyrifera* (bladder kelp) is a large seaweed species that can form extensive undersea forests in coastal waters around the southern North Island, the South Island, Chatham Islands, Stewart Island, and the sub-Antarctic islands. Individual plants can grow up from depths of 30 m to reach the sea surface where they form a floating canopy. The canopies can be extensive, reaching many metres in length along the sea surface. In older plants, over 50% of the plant biomass can be within 1 m of the sea surface.
- 22 Bladder kelp typically occurs in dense stands and is the predominant habitat forming species in many coastal ecosystems. This seaweed undergoes annual and seasonal cycles of abundance; with canopy growth rates generally highest between autumn and spring. Canopy biomass is typically greatest during winter and lowest during summer (due to die-off from higher water temperatures and lower nutrient levels). Storm events substantially contribute to a decline in surface-canopy biomass. A significant proportion of the annual kelp production becomes free-floating and beach-cast as a result of storm events, seasonal mortality, or senescence.
- 23 Bladder kelp is one of the fastest growing seaweed species and the fronds of plants have been recorded as growing up to 300 mm per day in length in the Northern Hemisphere.¹⁰ In New Zealand, however, growth rates have been estimated at significantly lower levels (approximately 1 – 15 mm per day).^{11,12} Growth rates and peaks in biomass can vary significantly over very short distances (i.e., a few kilometres apart) in response to changes in currents, light, nutrient levels, and other environmental factors. Kelp beds experience decline and regeneration over different spatial and temporal scales, ranging from metres to kilometres, and days to years, respectively.
- 24 Bladder kelp forests are characterised as being amongst the most productive marine communities in New Zealand. Attached bladder kelp forests play a critical role in coastal, inshore and estuarine environments by providing a wide and diverse range of ecosystem services. These include:
- a) Providing important three-dimensional structures that act as nurseries, shelters, and refuge habitats for a wide variety of coastal and inshore species of high social, cultural and economic value (e.g. paua, kina, and butterfish);

¹⁰ North, W.J. 1971. Growth of individual fronds of the mature giant kelp, *Macrocystis pyrifera*. *Nova Hedwigia* 32: 123-168.

¹¹ Brown, M.T., Nyman, M.A., Keogh, J.A., and N.K.M. Chin. 1997. Seasonal growth of the giant kelp *Macrocystis pyrifera* in New Zealand. *Marine Biology* 129: 417-424.

¹² Pirker, J.G. 2002. Demography, biomass production and effects of harvesting giant kelp *Macrocystis pyrifera* (Linnaeus) in southern New Zealand. PhD Thesis, University of Canterbury.

Pirker, J., Schiel, D.R., and H. Lees. 2000. Seaweed Products for Barrel Culture Paua Farming. Foundation for Research Science and Technology's Technology for Business Growth Development project.

- b) Providing food for a wide range of species (e.g. paua, kina and butterflyfish) that support a variety of coastal, inshore and estuarine foodwebs and fisheries;
- c) Modifying wave and tidal action, which affects species living in and around kelp beds, as well as coastal physical processes such as erosion, siltation, and sunlight penetration (affecting sheltered and shaded understory species); and
- d) Driving primary production and energy cycling that contribute to other near-shore systems including sandy beaches and deepwater ecosystems.

Fishery Background

- 25 Currently there are two commercial fishers in FMA3 and one commercial fisher in FMA4 authorised to target attached bladder kelp under s 91 permits. From 2004, the permit holders in FMA3 were restricted to a combined competitive catch limit of 20 t of attached bladder kelp per fishing year in Akaroa Harbour only. The single permit holder in FMA4 was restricted to 25 t of attached bladder kelp per fishing year.
- 26 Over the past six fishing years (2003-09), an average annual catch of 17 t has been reported from FMA3. Annual reported bladder kelp landings ranged between 8 and 17 t, with the exception of the 2008-09 fishing year where approximately 63.5 t was reported. The majority of these catches were taken from Akaroa Harbour. MFish assumes that 20 t of bladder kelp was taken as attached bladder kelp (as per the current competitive catch limit allowed under the s 91 permit) and the remaining harvest was free-floating or beach-cast bladder kelp.
- 27 A total catch of less than 2 t has been reportedly taken from FMA4 over the past 10 years, with all catches landed between the 1999-00 and 2001-02 fishing years.

Stock Status

- 28 There is no stock assessment information to determine current stock biomass or sustainable yield of either KBB3G or KBB4G. Therefore, MFish is unable to ascertain whether the current biomass of both attached bladder kelp stocks is stable, increasing or decreasing. Attached bladder kelp stocks are considered to be near virgin biomass levels, as most kelp beds are either un-fished or lightly fished. The NABIS¹³ database indicates other hotspots of abundance but there is limited information on the size and density of these other beds, and the information cannot be taken to accurately define local distribution.

KBB3G (East Coast South Island)

- 29 Estimates of bladder kelp biomass and/or potential yield have been calculated in Akaroa Harbour (Wainui, Ohinepaka, and Mat White Bays)¹⁴ and Pleasant River (Otago)¹⁵. The Akaroa Harbour study estimated a combined annual harvestable *canopy* biomass between the spring of 1995 and winter 1998 ranging between 0 and 377 t. Approximately 50% of the kelp biomass in Akaroa Harbour is in the canopy at peak biomass times. The total surveyed biomass (*entire* plants) near Pleasant River (November 1995) ranged between 6600 and 9200 t. Therefore, the total historical survey biomass recorded in KBB3G is estimated to be between 6600 and 9954 t.¹⁶

¹³ www.nabis.govt.nz

¹⁴ Ibid no. 9.

¹⁵ Ibid no. 3.

¹⁶ Biomass was calculated by adding the maximum total biomass estimate from Pleasant River to double the maximum canopy estimate from Akaroa Harbour (assumes 50% of the total plan biomass is located in the canopy): $9200 + (2 * 377) = 9954$ t

Estimate of Yield

- 30 Using the best available information, MFish considers that an average Maximum Constant Yield (MCY)¹⁷ can be estimated using an estimate of natural mortality (M) as a substitute for fishing mortality ($F_{0.1}$).¹⁸ Where $M = 0.75$, MCYs of 1238 and 1866 t are calculated using 6600 and 9954 t as estimates of B_0 , respectively.
- 31 MFish acknowledges that both MCY estimates are much less than the recommended yields by some submissions (e.g. 3000 t). Pirker et al. (2000) suggest each bed in total should not be cropped more than its total biomass in any given year. This analysis assumes 50% of kelp biomass is present in the canopy at peak biomass times and available for harvest, which would equate to annual harvestable yields of 6600 and 9954 t. However, MFish prefers the MCY estimates of 1238 and 1866 t as they are generated from actual growth data rather than assumptions of what the kelp may be able to sustain. Growth and mortality are, however, likely to vary spatially; in the absence of better information, MFish has taken a conservative approach to application of these growth rates to unstudied locations.

KBB4G (Chatham Islands)

- 32 Areas identified in submissions where significant stands of bladder kelp occur that are likely suitable for harvest include: Pitt Island, Waitangi West (including Two Bung), Owenga and Okawa Point. Aerial images taken between February and May 2005 and ArcGIS software were used to estimate percent cover of each bed and a net area of all beds combined.¹⁹ Accounting for potential inaccuracies in the estimates, available canopy area was calculated to be between 42.53 and 63.82 ha. Using the conversions from Pirker et al. (2000) to estimate forest harvestable biomass from forest harvestable area²⁰, canopy biomass was subsequently calculated to be between 1460 and 2190 t.

Estimate of Yield

- 33 Using the best available information, MFish considers that an average MCY can be estimated using the same estimate of M as a substitute for $F_{0.1}$ as for KBB3G. This equates to MCYs of 274 and 411 t using 1447 and 2170 t as estimates of B_0 , respectively.
- 34 MFish acknowledges that both MCY estimates are much less than the 1000 t yield (or TAC) recommended by some submissions. MFish generated the MCY estimates (274 and 411 t) using actual growth data and the same natural mortality estimates derived from Akaroa Harbour (KBB3G) rather than assumptions of what the kelp may be able to sustain. Although the Chatham Islands are more exposed than Akaroa Harbour, the use of maximum age data from Akaroa Harbour in KBB4G is likely to predict a conservative MCY (i.e. less MCY than might be generated using a lower maximum age likely occurring in the KBB4G). Data on growth and mortality from the Chatham Islands would be preferable to use in this calculation, but does not presently exist.

¹⁷ $MCY = 0.25 * F_{0.1} * B_0$, where B_0 = virgin biomass

¹⁸ M was calculated from the mean survival rate (S) for four different size classes of attached bladder kelp as estimated in Pirker (2002). When the mean S is calculated (across all size classes), an estimate of $M = 0.75$ is derived by solving for the exponential relationship between mortality and age.

¹⁹ MFish thanks Maurice Wills at Environment Canterbury for information on the dates for specific images, the DOC Wellington Hawkes Bay regional area office and Paul Hughes for technical assistance.

²⁰ Forest harvestable area (m^2) * 0.00343 = forest harvestable biomass (tonnes), where 1 ha = 10 000 m^2

Areas of Uncertainty

- 35 MFish considers the methods used to estimate biomass and yield are satisfactory but:
- a) The Akaroa Harbour survey provides only seasonal point estimates of harvestable biomass between 1995 and 1998, with the 377 t estimate being the highest and 0 t being the lowest.
 - b) The Pleasant River survey provides only a snapshot of total biomass for one bed in two years. Fyfe et al. (1998) also noted a significant reduction in bladder kelp density, and differences in biomass, between November 1995 and November 1996.²¹
 - c) The bulk of our KBB3G biomass estimate is from the one point estimate taken from Pleasant River. There is a risk that potential yield calculated from a relatively high or low biomass, would equate to either an over- or underestimate of sustainable take.
 - d) However, estimated biomass in Akaroa Harbour in November 1995 (when biomass was calculated in Pleasant River) was intermediate compared to the range seen from October 1995 to June 1998.²² Growth over time at different sites within Akaroa Harbour is correlated. Assuming the correlation is true over larger scales, the snapshot biomass from Pleasant River is unlikely to be at either extreme (compared to the 2.5 years of data available from Akaroa Harbour).
 - e) The biomass estimates for KBB4G were estimated from aerial images taken in 2005 are historical and enable only point estimates of harvestable biomass to be calculated.
- 36 All available biomass estimates are historic and do not provide an indication of biomass at a FMA level; however, the kelp beds are considered to be much more extensive than what has been surveyed to date and could provide significant harvest opportunities. Extrapolating historical survey data over other areas of known bladder kelp distribution is not ideal when the location, size and density of these other beds are unknown. This is addressed by taking a conservative approach to the current estimates of biomass and yield.
- 37 Annual biomass variations within and between individual kelp forests necessitates the need for annual stock assessments of targeted beds in the long-term to determine credible biomass and sustainable yield information to ensure continuing sustainability. In the absence of this information MFish recommends setting a cautious catch limit relative to the overall biomass to ensure sustainability.
- 38 MFish acknowledges industry submissions that consider kelp distribution can be mapped at low cost and reasonable time using aerial photographs, or gathering in situ biomass estimates to support annual stock assessments. MFish supports efforts by industry to identify the location and quantify the size of the kelp beds in KBB3G and KBB4G that can be used to better estimate current available biomass and potential harvestable yield in the future.

²¹ The estimated density (algae/m²) in "closed canopy" beds (i.e. very few gaps in the canopy) decreased from 1.16 ± 0.13 to 0.41 ± 0.05. The estimated biomass decreased by more than 30% from 10639 ± 1566 to 3761 ± 1237 g m⁻².

²² Ibid no. 9.

Management Options

- 39 There are no long-term studies on the implications of commercial harvesting of attached bladder kelp beds in New Zealand to guide TAC setting. However, MFish has examined international management frameworks for bladder kelp and other similar species to identify measures that may be useful to manage and guide bladder kelp harvesting in New Zealand. A number of submissions cited the lack of information in the New Zealand context as reason to proceed cautiously or postpone the setting of the TACs until more information is available. Although there is insufficient information available to estimate total biomass across the entire QMAs for KBB3G or KBB4G, MFish considers there is sufficient historical information to set introductory TACs for both stocks based on available biomass estimates from surveyed areas and aerial images.
- 40 In setting or varying sustainability measures, you must act in a manner consistent with New Zealand's international obligations to fishing and the provisions of the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992. MFish is not aware of any specific international obligations that would be affected by the proposed TACs and allowances and considers the proposed options are consistent with the obligations relating to the Settlement Act. All proposals seek to maintain good fishing opportunities, or improve stock health and provide utilisation opportunities, for all sectors including commercial and customary Maori.

Total Allowable Catch Setting

- 41 In setting TACs for KBB3G and KBB4G for the first time, you need to consider whether to set the catch limit under s 13 or s 14 of the Act. In general, TACs are set in accordance with the provisions of s 13(2) of the Act in a manner that would maintain, or move the stock towards, a biomass at or above the level that can support Maximum Sustainable Yield (MSY)²³.
- 42 Where reliable estimates of $B_{CURRENT}$ and B_{MSY} are not available, s 13(2A) of the Act provides for you to use the best available information to set a TAC that is not inconsistent with the objective of maintaining the stock at or above, or moving the stock towards or above, B_{MSY} . Section 13(2A) requires you to have regard to the interdependence of stocks, the biological characteristics of the stock, and any environmental conditions affecting the stocks.
- 43 You must not use the absence of (or uncertainty in) the best available information as a reason for postponing or failing to set a TAC. In considering the way in which and rate at which a stock is moved towards or above B_{MSY} , you must have regard to such social, cultural, and economic factors as you consider relevant.
- 44 Alternatively, the Act allows TACs to be set under s 14 if the quota management stock is listed on the Third Schedule (i.e. stocks managed with an alternative total allowable catch). A stock can be added to the Third Schedule provided it satisfies one of four criteria specified in s 14(8)(b):
- It is not possible, because of the biological characteristics of the species, to estimate MSY. MFish considers that MSY could be estimated for attached bladder kelp.²⁴

²³ Maximum sustainable yield is the largest long-term average catch or yield that can be taken from a stock under prevailing ecological and environmental conditions. It is the maximum use that a renewable resource can sustain without impairing its renewability through natural growth and reproduction.

²⁴ Using the MCY calculation (which is a proxy for MSY) for New Fisheries, p. 26 of the current plenary document.

- A national allocation for New Zealand has been determined as part of an international agreement. There are no international agreements regarding bladder kelp.
 - The stock is managed on a rotational or enhanced basis. Attached bladder kelp is not yet in the QMS and therefore not currently managed on this basis. MFish considers both stocks are well suited to rotational harvest strategies and could be managed this way in the future under a harvest strategy.
 - The stock comprises 1 or more highly migratory species. Bladder kelp is not a highly migratory species.
- 45 SeaFIC considers that the high variability in annual and seasonal biomass, and distribution of bladder kelp (including storm removals), would make it very hard to calculate B_{MSY} . SeaFIC also considers that if only the canopy of bladder kelp beds were harvested then B_{MSY} is not a valid consideration, and that s 14 is relevant to the setting of initial TACs for both stocks. MFish considers TACs of both stocks under s 14 may be preferable; however in the absence of recent information a conservative TAC using a MCY approach is appropriate.
- 46 MFish considers that given the best available information at this time it is appropriate to set the TACs for KBB3G and KBB4G under s 13(2A) as there are no current biomass estimates for either stock and no rotational harvest strategy in place. A rotational harvest strategy could be considered by quota-holders once quota is allocated. Such an approach has a higher cost but is likely to allow higher levels of utilisation in years where biomass is high.
- 47 MFish considers the TAC options proposed for both stocks are consistent with your statutory obligations under s 13, with respect to maintaining or moving the stocks to a point at or above a level that can produce the MSY, having regard to the interdependence of stocks, and environmental conditions affecting the stocks (discussed further in the Sustainability Measures – Considerations section).

Sustainability Measures - Considerations

48 Relevant matters for you to take into account in setting or varying a TAC include:

- Any effects of fishing on any stock and the aquatic environment. Research overseas has shown that harvest of bladder kelp canopies does not appear to have significant effects on the bladder kelp beds themselves, but potential effects on associated species are inconclusive.²⁵ MFish acknowledges that the majority of available research has been conducted off the California coast where the scale and size of bladder kelp beds are much larger and the physical environment different than in New Zealand. MFish notes new information on the potential ecological impacts of bladder kelp harvesting in New Zealand will likely be available in the next three years to support future decision-making (see *Future Information*).
- Any existing management controls under the Act that apply to the stock or area concerned. Entry to the QMS will remove the current hand-gathering method restriction in both QMAs and the restriction constraining harvest in FMA3 to Akaroa Harbour only. No other management controls other than the generic fishing restrictions prescribed under the Act and fisheries regulations will apply.
- The natural variability of the stock. Individual bladder kelp beds demonstrate significant abundance and distribution fluctuations over both time and space in response to storm events, changes in sea temperature, nutrient levels, land run-off, siltation, and variable recruitment and growth cycles. Their vulnerability to other environmental stressors means the effects of fishing may compound biomass variability across different temporal and spatial scales. Some submissions expressed concern about the decline observed in bladder kelp beds in both California and Tasmania over the past decade where multiple stressors are considered to contribute. MFish notes that the decline of the bladder kelp beds in Tasmania and California have been most strongly linked to changes in water temperature, major El Nino episodes, and changes in predator populations (not commercial harvest).²⁶ This natural variability has been considered in setting the proposed TACs.

49 You must also take into account the following environmental principles:

- Associated or dependent species should be maintained above a level that ensures their long-term viability;
- Biological diversity of the aquatic environment should be maintained; and
- Habitat of particular significance for fisheries management should be protected.

50 Submissions highlighted specific concerns about the potential adverse effects of

²⁵ For reviews see:

Barilotti, D.C., and J.A. Zertuche-Gonzalez. 1990. Ecological effects of seaweed harvesting in the Gulf of California and Pacific Ocean off Baja California and California. *Hydrobiologica* 204/205: 35-40.

Dayton, P.K., Tegner, M.J., Edwards, P.B., and K.L. Riser. 1998. Sliding baselines, ghosts, and reduced expectations in kelp forest communities. *Ecological Applications* 8: 309-322.

Druehl, L.D., and P.A. Breen. 1986. Some ecological effects of harvesting *Macrocystis integrifolia*. *Botanica Marina* 29: 97-103.

Graham, M.H., Vasquez, J.A., and A.H. Buschmann. 2007. Global ecology of the giant kelp *Macrocystis* from ecotypes to ecosystems. *Oceanography and Marine Biology: An Annual Review* 45: 39-88.

²⁶ Edyvane, K. 2003. Conservation, monitoring & recovery of threatened giant kelp (*Macrocystis pyrifera*) beds in Tasmania – Final Report. Report to Environment Australia (Marine Species Protection Program).

harvesting on: rock lobster, paua, kina, yellow-eyed and grey mullet, blue and red cod, butterfish, mackerel, kahawai, and potential indirect effects on Maui, Hector, and Dusky dolphins. No direct scientific evidence is available to either support or refute these concerns; however biogenically structured habitats (which includes kelp beds) can increase overall diversity, abundance, and productivity of a range of species that associate with them, including small fish.²⁷

- 51 MFish acknowledges a lack of FMA-scale information on New Zealand's bladder kelp beds (e.g. distribution, size, growth rates) and the potential effects of harvest on bladder kelp beds themselves; associated and/or dependent species; and other coastal processes.
- 52 Submitters have raised concern about increased encroachment of the invasive seaweed *Undaria pinnatifida*, as a result of harvesting of bladder kelp and which could modify current community structure and biodiversity. *Undaria* exists along the south east coast of the South Island (KBB3G) but is not currently present in the Chatham Islands (KBB4G). *Undaria* is an opportunistic species and colonises surfaces where little or no macro seaweeds occur. The harvest of attached bladder kelp could promote the emergence of new stands of *Undaria* and may have a localised impact on various native marine flora and fauna species.
- MFish acknowledges that regular disturbance of the seabed or canopy removal of native algal species can result in increased recruitment and establishment of *Undaria* in high densities.²⁸ While disturbance could occur as a result of natural storm events, this type of irregular disturbance would likely have less impact than regular harvest. *Undaria* appears to establish more prolifically in areas with low diversity or biomass of native macroalgae (e.g. bladder kelp) or where beds have been completely removed.
 - Biosecurity New Zealand has relaxed some controls on the removal of *Undaria*, but harvest of *Undaria* growing on natural surfaces is still prohibited, except when part of a control programme. You are advised to consider the risks of exacerbating spread of *Undaria*, which may inhibit recruitment and maintenance of bladder kelp beds and reduce or modify local biodiversity.
- 53 MFish recognises that bladder kelp is essential to the functioning of coastal, inshore and estuarine ecosystems, and must be carefully managed to ensure long-term sustainability of the diverse range of marine communities it supports. MFish considers these issues can be managed with appropriately set TACs and consideration of additional harvest management measures to address potential interactions or effects on associated and/or dependent species.
- 54 MFish does not have a clear policy on defining habitats of significance. In this context, no habitats of significance have been identified in either KBB3G or KBB4G.
- 55 You must also have regard to or take into account certain other matters: (a) any regional policy statement, regional plan or proposed regional plan under the Resource Management Act 1991; (b) any management strategy or management plan

²⁷ Morrison, M., Consalvey, M., Berkenbusch, K., and E. Jones. 2008. Biogenic habitats and their value to New Zealand fisheries. *Water & Atmosphere* 16(4): 20-21.

²⁸ Edgar, G.J., Barrett, N.S., Morton, A.J. and C.R. Samson. 2004. Effects of algal canopy clearance on plant, fish and macroinvertebrate communities on eastern Tasmanian reefs. *Journal of Experimental Marine Biology and Ecology* 312: 67-87.

Stuart, M.D. 2004. Review of research on *Undaria pinnatifida* in New Zealand and its potential impacts on the eastern coast of the South Island. DOC Science Internal Series 166, Department of Conservation, New Zealand.

Valentine, J.P., and C.R. Johnson. 2003. Establishment of the introduced kelp *Undaria pinnatifida* in Tasmania depends on disturbance to native algal assemblages. *Journal of Experimental Marine Biology and Ecology* 295:63-90.

under the Conservation Act 1987 that apply to the area and are considered relevant; (c) ss 7 and 8 of the Hauraki Gulf Marine Park Act 2000; (d) any conservation services or fisheries services and any decision not to require conservation services or fisheries services; and (e) any relevant fisheries plan approved under s 11(2A) of the Act.

- a) KBB3G and KBB4G include the coastlines that are covered by the Regional Coastal Environment Plan for the Canterbury Region (RCEP) and the Chatham Island Resource Management Plan (CIRMP), respectively. These plans consider the importance of coastal margins to ensure they are protected and secured. Because bladder kelp performs a wave dampening function on some erodible coastlines, consideration should be given to the fact that the RCEP and CIRMP deal with the broader issue of coastline erosion, primarily by restricting development in the coastal hazard zone. You should consider the risks associated with enabling any new activity that could impact on coastal erosion (based on the Government's support for active management of coastal erosion). MFish acknowledges the important wave dampening and current modifying role bladder kelp beds play and considers that harvest can be conducted in a manner that preserves much of the bed structure to retain much of its function as a coastal barrier. MFish supports any efforts by territorial or regional councils to protect coastal margins from erosion and will provide support where possible to ensure the functionality of bladder kelp beds and their contributions to ecosystem services are retained.
- b) There are four Department of Conservation Conservancies with jurisdictional boundaries covering KBB3G and one for KBB4G. MFish notes the existence of Pohatu (Flea Bay) marine reserve on the south east of Banks Peninsula. MFish does not consider that the proposed TACs will detract from the intent of any existing or future marine reserve.
- c) KBB3G and KBB4G do not intersect with the Hauraki Gulf Marine Park; therefore there are no relevant considerations under the Hauraki Marine Park Act 2000.
- d) MFish notes that National Inshore Fisheries Plans are currently in development and seaweeds are a part of this process. MFish expects that the relevant plan would include an assessment of risks to sustainability of the bladder kelp fishery and could incorporate conservation services or fisheries services (e.g. tools to mitigate impacts on the surrounding aquatic environment).

Assessment of Management Options

- 56 MFish considers none of the options proposed for either stock are inconsistent with your statutory objective of managing either stock at or above B_{MSY} based on likely but unquantified biomass across the wider QMA. However, MFish considers the potential risks associated with adverse effects from harvesting²⁹ vary considerably across the TAC options.

²⁹ Adverse effects from harvesting are defined as:

- localised depletion of kelp beds;
- reduced growth rates of kelp plants;
- negative impacts on associated and/or dependent species (e.g. kina, butterfish, mullet) that utilise kelp forests as a food and shelter source (potential for increased competition);
- opportunistic establishment of invasive algae (e.g. *Undaria* sp.);
- cascading trophic effects from kelp plant removal; and
- effects on wave and current action that facilitate the recruitment of planktonic larvae to kelp ecosystems.

KBB3G (East Coast South Island)

Option 1 – TAC 1866 tonnes

- 57 Option 1 has been developed following the IPP based on information supplied in submissions to calculate a MCY from the highest surveyed estimate of bladder kelp biomass in KBB3G [see *Stock Status*]. This option is much less than the TAC proposed in some submissions (e.g. 3000 t) because the yield estimate is based on actual growth data rather than what the bladder kelp may be able to sustain. MFish notes the following uncertainties and environmental risks under Option 1:
- a) The two surveys provide historic seasonal point estimates of harvestable biomass. Bladder kelp beds are highly variable within and between years (as evident in the survey results).
 - b) The effect of intensity of harvesting at this level in New Zealand has not been investigated and the potential impact on bladder kelp bed recovery, associated and/or dependent species, and ecosystem services is unknown. There is no information available to quantify this risk.
 - c) Adverse effects of harvesting may result if harvest occurs in area where bladder kelp plays an important role ensuring the long-term viability of associated species (e.g. paua, kina). Research on the potential impacts of harvest has been restricted to assessing short-term impacts of small-scale removal of bladder kelp (in one location only in Akaroa Harbour) on the beds themselves, and some associated seaweed species.³⁰
- 58 In the absence of a harvest strategy or mitigating measures, MFish considers Option 1 poses the largest level of risk regarding potential adverse effects from harvesting. These potential adverse effects may be managed to a significant degree through implementation of additional harvest management measures discussed in *Chapter 2*.
- 59 Option 1 provides the maximum development opportunity for KBB3G and a minimum 2900% increase in current utilisation levels. Setting a TAC at this level will provide industry with the greatest opportunity to develop the fishery and increase the potential economic value derived from this stock.

Option 2 – TAC 1238 tonnes

- 60 Option 2 has been developed following the IPP based on information supplied in submissions to calculate a MCY from the lowest surveyed biomass estimate of bladder kelp in KBB3G [see *Stock Status*]. MFish considers the potential for adverse effects from harvesting in localised areas and flow-on effects to other ecosystem services in Option 2 are comparable to those outlined under Option 1, and unacceptable in the absence of a harvest strategy or mitigating measures..
- 61 Option 2 provides a significant development opportunity for KBB3G and a minimum 1950% increase of current utilisation levels.

Option 3 – TAC 377 tonnes

- 62 Option 3 was one of the options originally consulted on and was supported by two submissions. Under Option 3, the TAC for KBB3G would be set at 377 t based on

³⁰ There are no assessments on the implications of timing or frequency of removal, large-scale harvest, or response of beds to harvest across large spatial scales. Investigation on associated and/or dependent species has focused on a few native fauna and invertebrate species. There has been no investigation on potential impacts on fish or other marine species.

the largest historical estimate of sustainable yield recorded in Akaroa Harbour³¹.

- 63 MFish notes there are other areas of kelp abundance within KBB3G (e.g. Pleasant River, Otago) which means this TAC is a conservative limit when applied to the QMA as a whole. The potential for adverse effects from harvesting is considered moderate compared to Option 1 and 2, but still significant in the absence of a harvest strategy.
- 64 Option 3 would enable a smaller increase in utilisation and development opportunity for KBB3G compared to Option 1 or 2, but still provide for a minimum 600% increase compared to current utilisation levels. Setting a TAC at this level will provide industry with a moderate opportunity to develop the bladder kelp fishery and increase the potential economic value derived from this stock.

Option 4 – TAC 41.2 tonnes

- 65 Option 4 was one of the options originally consulted on and was supported by two submissions. Under Option 4, the TAC for KBB3G would be set at 41.2 t, which reflects the permit conditions that currently apply (i.e. 20 t), and considers the opportunity for a cautious expansion of the fishery by providing an additional 21.2 t of allowable catch. MFish notes that 63.5 t of bladder kelp was landed during the last fishing year, but assumes that only 20 t of bladder kelp was attached relative to other states (i.e. free-floating or beach-cast).
- 66 Option 4 is considered to be much lower than the biomass and sustainable yield available across KBB3G, particularly in areas where kelp beds are understood to be sporadically prolific. While the current sustainable yield from Akaroa Harbour has probably fluctuated (either increased or decreased) in response to annual and seasonal variability, MFish considers it is likely to be well in excess of the proposed TAC under Option 4 given the historical abundance of kelp in this area. The potential for adverse effects from harvesting is low under this option, although localised adverse effects are possible if harvest is concentrated in only a few areas.
- 67 Option 4 would double current levels of utilisation and socio-economic benefit from the stock, but provide for minimal development opportunities compared to Options 1 to 3.

Option 5 – TAC 18.2 tonnes

- 68 Option 5 was one of the options originally consulted on and was supported by five submissions. Under Option 5, the TAC for KBB3G would be set at 18.2 t, which reflects the average annual commercial utilisation (17 t) of bladder kelp in FMA3 (from 2003-04 to 2008-09) while providing for additional utilisation by customary and recreational sectors, and other sources of fishing-related mortality.
- 69 Compared with Options 1 to 4, Option 5 poses the lowest risk of potential adverse effects from harvesting. MFish considers the proposed TAC of 18.2 t to be a highly conservative estimate of the sustainable yield that could be harvested from the entire QMA given the sustainable biomass that is likely to be available, and recent commercial utilisation of bladder kelp in KBB3G.
- 70 Option 5 would reduce current utilisation below the current permit limit on commercial catch (20 t) and therefore reduce socio-economic benefit from the stock.

³¹ Ibid no. 9.

KBB4G (Chatham Islands)

Option 1 – TAC 411 tonnes

- 71 Option 1 has been developed following the IPP based on aerial images taken off the Chatham Islands in 2005 [see *Stock Status*]. This option is much less than the TAC proposed in some submissions (i.e. 1000 t), because of a lack of information on the full extent of potential harvestable biomass, growth rates and natural mortality in KBB4G.
- 72 MFish notes the following uncertainties and environmental risks under this option:
- a) Kelp beds vary considerably spatially and temporally, and the biomass estimates calculated from aerial images provide only a historic point estimate.
 - b) The effect of intensity of harvesting at this level in the Chatham Islands has not been investigated and the potential impact on bladder kelp bed recovery is unknown. Over the past 10 years (1999-2009), a total catch of less than 2 t has been reportedly taken from the QMA.
 - c) Adverse environmental effects may result if harvest occurs in area where bladder kelp forms a habitat of significance for fishery management and/or leads to impacts on associated species. There have been no investigations on the potential adverse effects from harvesting in KBB4G.
- 73 MFish considers Option 1 poses the highest level of risk from potential adverse effects of harvesting, in the absence of a harvest strategy or mitigating measures. The potential adverse effects of harvesting on localised areas and associated and/or dependent species may be managed to a significant degree through implementation of additional harvest management measures discussed later.
- 74 Option 1 provides the maximum level of utilisation and immediate development opportunity for KBB4G and a minimum 1644% increase of current utilisation levels. Setting a TAC at this level will provide industry with the greatest opportunity to develop the bladder kelp fishery and increase the potential economic value derived from this stock.

Option 2 – TAC 271 tonnes

- 75 Option 2 has been developed following the IPP based on information supplied in submissions to calculate a MCY using the lower biomass estimate from aerial images of bladder kelp beds off the Chatham Islands in 2005 [see *Stock Status*].
- 76 MFish considers the risk of adverse effects from harvesting in localised areas and flow-on effects to other ecosystem services in Option 2 are comparable to those outlined under Option 1.
- 77 Option 2 provides for immediate development opportunities for KBB4G and a minimum 1096% increase of current utilisation levels. Setting a TAC at this level will provide industry with an opportunity to develop the bladder kelp fishery and increase the potential economic value derived from this stock.

Option 3 – TAC 26.2 tonnes

- 78 Option 3 was one of the options originally consulted on and was supported by two submissions. Under Option 3, the TAC for KBB4G would be set at 26.2 t. This TAC

reflects the commercial catch limit of 25 t that currently applies to KBB4G. This catch limit was prescribed on a s 91 fishing permit held by the only commercial fisher entitled to harvest bladder kelp in FMA 4 under the previous statutory regime.

- 79 Although there is no stock assessment information available to determine whether a TAC of 26.2 t is sustainable, Option 3 is unlikely to pose a sustainability risk to KBB4G. Potential adverse effects from harvesting could occur if the entire TAC is taken from one or few small areas, but this risk is considered low.
- 80 Option 3 maintains the current level of utilisation and does not provide for any additional development opportunities for KBB4G.

Option 4 – TAC 2.2 tonnes

- 81 Option 4 was one of the options originally consulted on and was supported by seven submissions. Under Option 4, the TAC for KBB4G would be set at a nominal 2.2 t. This TAC option originally reflected the:
- a) lack of commercial harvesting that has occurred in the area despite permit conditions that would have enabled an annual commercial harvest of 25 t;
 - b) lack of stock assessment information to set sustainable catch limits; and
 - c) lack of information regarding which areas in the Chatham Islands could sustain higher levels (and what those levels might be) of bladder kelp removal in light of the seaweed's ecological role in the marine environment.
- 82 New information provided in submissions identified areas around the Chatham Islands that could sustain higher levels of utilisation and enabled additional options being put forward for your consideration (i.e. Options 1 and 2). Option 4 poses a low risk of localised depletion or consequential adverse effects from harvesting on associated and/or dependent species.
- 83 Option 4 reduces current utilisation opportunities for KBB4G.

Allocation of the TAC

- 84 When setting any TAC, that TAC must be apportioned between the relevant sectors and interests set out under the provisions of s 21 of the Act. Section 21 requires you to allow for Maori customary non-commercial interests, recreational fishing interests, and for any other sources of fishing-related mortality, when setting or varying the TACC.
- 85 The Act does not provide an explicit statutory mechanism to apportion available catch between sector groups either in terms of a quantitative measure or prioritisation of allocation. Accordingly, you have the discretion to make allowances for various sectors based on the best available information.

Customary Maori and Recreational allowances

- 86 MFiSh proposes to set initial customary Maori and recreational allowances of 0.1 t (greenweight), respectively, under all options presented for KBB3G and KBB4G (Table 1). MFiSh notes non-commercial harvest is unrestricted and any non-commercial fisher can harvest bladder kelp in any state, from any harvest area, and in any quantity.
- 87 In submissions, option4 opposes a nominal 0.1 t allowance for non-commercial

fishing interests as this fails to recognise that environmental, cultural and social interests vary from area to area and could extend to the entire bladder kelp population. Hough and BJ Thomas also emphasise bladder kelp's importance to the customary sector.

- 88 For stocks where no customary Maori and recreational harvest estimates are available and where the stock is not considered to be of importance to the customary and recreational sectors, MFish recommends nominal allowances to account for these harvests. MFish did not receive any additional information in submissions regarding amounts of customary Maori and recreational harvest of attached bladder kelp within KKB3G and KBB4G, but acknowledges its importance to the customary sector.
- 89 When allowing for Maori customary non-commercial interests you must take into account any relevant mātaimai reserve and any area closure or fishing method restriction or prohibition under s 186A. MFish notes there are a number of mātaimai within KBB3G (Mataura River, Puna-wai-Toriki mātaimai) where commercial fishing is prohibited. Additionally, there is a section 186A closure (Kaikoura-Wakatu Quay) where no person may take any species of fish, aquatic life, or seaweed.
- 90 When allowing for recreational interests, you are required to take into account any regulations that prohibit or restrict fishing in the areas concerned. There are a number of regulations (e.g. marine reserves) within both KBB3G and KBB4G that would affect recreational utilisation of bladder kelp. MFish does not consider that the proposed allowances for recreational harvest will detract from the intent of any existing or future s 311 closures in either KBB3G or KBB4G.
- 91 MFish contends the proposed 0.1 t allowances for customary Maori and recreational interests, respectively, reflect realistic harvest levels for attached bladder kelp. These allowances can be revised if new information becomes available.

Allowance for other sources of fishing-related mortality

- 92 MFish proposes to set an initial allowance for other sources of fishing-related mortality of 1 t (greenweight) under all TAC options for KBB3G and KBB4G (Table 1). For stocks where there is no information on the extent of other sources of fishing-related mortality, MFish guidelines provide a nominal allowance to account for this harvest.
- 93 There is no quantitative information on the quantity of attached bladder kelp taken as incidental bycatch in other target fisheries. While some attached bladder kelp is likely to be collected as a result of using fishing gear over kelp beds, this catch is likely to be negligible. The vast majority of seaweed taken as bycatch in various fishing gear would comprise of free-floating material. MFish considers there is no or negligible illegal catches of attached bladder kelp.
- 94 Some submissions consider that the potential use of mechanical gathering methods could result in an increased mortality of attached bladder kelp. MFish considers that standard harvesting practices used overseas restrict harvest to the canopy alone, which does not result in mortality of the entire plant. MFish considers that if harvest was restricted to the canopy mortality from fishing-related activity would remain small. If mechanical harvesting increases in prevalence and information suggests other sources in mortality is increasing, adjustments to the allowance can be made in the future.
- 95 MFish considers the proposed 1 t allowances reflect a realistic level of other sources

of fishing-related mortality and can be revised if new information becomes available.

Total Allowable Commercial Catch (TACC)

- 96 Sea-Right considers that the harvest of attached bladder kelp and enhanced product development will lead to substantial local and export industries, and suggests an initial market value of \$2 or \$4 per kg. MFish has used this information with general reported market value for seaweed to estimate potential economic returns from each option (Tables 2 and 3).

KBB3G (east coast South Island)

Table 2: Proposed TACCs (t) and corresponding estimated economic return (\$ millions) for KBB3G

	Proposed TACC (tonnes)	Potential revenue (\$ millions)
Option 1	1864.8	3.7 – 7.5
Option 2	1236.8	2.5 – 5.0
Option 3	375.8	0.75 – 1.5
Option 4	40	0.08 – 0.16
Option 5	17	0.03 – 0.06

- 97 Maximum commercial catch from KBB3 to date has been 63.5 t (20 t assumed to be attached bladder kelp). Under Option 1, the TACC would create the largest incentives for quota-holders to invest and develop the fishery based on the guaranteed harvest level. This incentive is lower under Option 2 but provides for a substantial increase in commercial development potential compared to current catch limits. Under Option 3, the TACC will create a moderate incentive for quota-holders to invest and develop the fishery based on the guaranteed harvest level. Option 4 provides a conservative approach, compared to Options 1 to 3, to develop a long-term sustainable bladder kelp fishery within KBB3G, and gives quota-holders moderate-low incentive to invest and rationally develop this fishery resource. Option 4 would maintain current levels of commercial utilisation and socio-economic benefit from the stock based on the existing permit condition, and provide for conservative expansion across the entire QMA. Under Option 5, the TACC reduces potential commercial utilisation compared to that currently allowed under the s 91 permit, and provides the lowest economic potential relative to the other options presented. Under lower TACC options, fishers may still be incentivised to invest in the fishery on the basis of future potential, subject to additional information being provided to support higher catch limits in the future. The allocation of rights provides certainty of future access and a share of any future catch increases.
- 98 MFish notes that it is unlikely that the proposed TACCs under Option 1 or 2 would be harvested in full in 2010-11 given recent commercial catches and a lack of established markets. All the options are unlikely to affect access by other fishing sectors because customary and recreational usage is considered low at present and generally concentrated on beach-cast or free-floating bladder kelp rather than attached.

KBB4G (Chatham Islands)

Table 3: Proposed TACCs (t) and corresponding estimated economic return (\$ millions) for KBB4G

	Proposed TACC (tonnes)	Potential revenue (\$ millions)
Option 1	409.8	0.82 – 1.64
Option 2	272.8	0.55 – 1.09
Option 3	25	0.05 – 0.10
Option 4	1	0.002 – 0.004

- 99 Under Option 1, the TACC would create the largest incentive for quota-holders to invest and develop the fishery. Option 2 is smaller than Option 1 but would still provide incentive for quota-holders to invest and immediate development opportunity for stakeholders.
- 100 Under Option 3, the TACC maintains the current catch limit available and does not provide for development opportunities and associated socio-economic benefits. Under Option 4, the TACC for would be set at 1 t, reducing any opportunity for quota-holders to derive economic value. The proposed TACC would provide minimal incentive for quota-holders to invest and rationally develop this fishery resource, or opportunities for collective action to help identify and manage any adverse effects of fishing.
- 101 Sea-Right considers Option 3 and 4 too small to allow investment in new business opportunities and would not provide any additional business opportunities to support or maintain the local community. Sea-Right notes that their current individual catch entitlement (ICE) for KBB4 is 25 t based on their long-standing permit and considers their ICE allocations cannot be prorated down.
- 102 MFish considers it unlikely that the commercial sector will harvest the proposed TACCs in Option 1 or 2 in full in 2010-11 based on historical commercial catches and a lack of established markets. Option 1 provides the largest level of utilisation and an opportunity for stakeholders to develop the fishery. All the options are unlikely to affect access by other fishing sectors because customary and recreational usage generally utilises beach-cast or free-floating bladder kelp rather than attached.

Other Management Measures

Deemed values

- 103 Under s 75(1) of the Act, you are required to set interim and annual deemed value rates for each quota management stock. Section 75(2A) requires you, when setting deemed value rates, to take into account the need to provide an incentive for every commercial fisher to acquire and hold sufficient annual catch entitlement (ACE) in respect of each fishing year that is not less than the total catch of that stock taken by the commercial fisher.
- 104 MFish developed a Deemed Value Standard in 2007 to set out a process for managing the setting, reviewing and amendment of deemed value rates.³² MFish considers the options proposed are consistent with the criteria outlined in the standard.
- 105 MFish acknowledges that there are small niche markets for high quality product and

³² <http://fs.fish.govt.nz/Page.aspx?pk=119>

a broader “general use” market for seaweed. The estimated landed price for bladder kelp can range between \$2.00 and \$20.00 per kg. In this deemed value analysis MFish is using an estimated landed price for bladder kelp of \$2.00 per kg, which is based on the general reported market value for seaweed. Based on this information, MFish proposed two options to set the annual and interim deemed value for attached bladder kelp:

Option 1	Set an annual deemed value rate of \$4.00 per kg and an interim deemed value rate of \$2.00 per kg.
Option 2	Set an annual deemed value rate of \$1.00 per kg and an interim deemed value rate of \$0.50 per kg.

Option 1

- 106 Option 1 sets the annual deemed value rate at twice the estimated landed price (\$2.00 per kg) for the 2010-11 fishing year. In adopting this approach, MFish proposes setting an interim deemed value rate at \$2.00 per kg (excluding GST) and an annual deemed value rate of \$4.00 per kg (excluding GST) for the KBB3G and KBB4G stocks for the 2010-11 fishing year.
- 107 Option 1 treats attached bladder kelp as if it is in the “high-value single stock” fish stock category as set out in the deemed value review standard. Besides being an ecologically valuable species, attached bladder kelp has the potential to enter into high quality niche markets potentially making it a highly valuable fishery. SeaFIC considers Option 1 confuses the meaning of value in the deemed value policy which relates to high monetary value not high ecological value.
- 108 Te Ohu supports Option 1 to set the annual and interim deemed value rates at \$4.00 and \$2.00 per kg, respectively. Te Ohu is unaware of any good reason for overharvesting without ACE. CIET considers the interim deemed value rate be set as high as possible at \$4.00 per kg.
- 109 MFish notes that attached bladder kelp is not yet in the QMS, meaning that there is no ACE price information available that can be used to determine the market value of attached bladder kelp and set deemed value rates.

Option 2

- 110 Option 2 sets the annual deemed value rate at 50% the estimated landed price (\$2.00 per kg) for the 2010-11 fishing year. In adopting this approach, MFish proposed setting an interim deemed value at \$0.50 per kg (excluding GST) and an annual deemed value of \$1.00 per kg (excluding GST) for the KBB3G and KBB4G stocks for the 2010-11 fishing year.
- 111 This option treats attached bladder kelp as if it is in the “all other” fish stock category as set out in the deemed value review standard. Fishstocks in this category are to have their annual deemed value rate set above ACE price and below landed price to encourage fishers to balance their catch with ACE rather than pay deemed values.
- 112 SeaFIC and PIC support Option 2 to set the annual and interim deemed values at \$1.00 and \$0.50 per kg, respectively. MFish considers Option 2 an appropriate way to provide incentive for fishers to balance catches with ACE and avoid harvesting on deemed values if landed prices increased during a fishing year. The rates can be adjusted depending on future information on catch versus TAC, port price and ACE price following introduction into the QMS.

Differential deemed values

- 113 For both Options 1 and 2, MFish proposes to apply standard differential annual deemed value rates to KBB3G and KBB4G for the 2010-11 fishing year. MFish proposes not to set an overfishing threshold for these seaweed stocks, unless future monitoring of catches suggests that this is required. SeaFIC does not support the application of differential deemed values for these stocks, and considers there should be no differentials in order to encourage the market to develop from low TACCs.
- 114 MFish notes that deemed value rates for KBB3G and KBB4G will be adjusted, as required, when information about ACE price becomes available. Currently deemed value rates for all species are reviewed on an annual basis. When information becomes available on the ACE price for the bladder kelp stocks, this will be incorporated into the annual deemed value review process to ensure the correct deemed value rates are set for all bladder kelp stocks.

Future Information

- 115 The majority of submissions have indicated their support for development of a research programme that examines long term distribution and abundance, harvesting relationships between attached and free-floating bladder kelp, effects of harvest on associated and/or dependent species, baseline information on bladder kelp beds (e.g. growth rates, size, productivity, post-harvest recovery).
- 116 MFish notes that ongoing and future research will further inform the ecological effects of kelp harvesting. This includes a recently funded 3-year research project by the Foundation for Research, Science and Technology (planned in consultation with both MFish and industry) is set to begin in 2010 that will examine the potential ecological effects of harvesting bladder kelp. This research will investigate potential effects that have been examined overseas as well as trophic impacts, which don't appear to have been studied elsewhere. These types of studies will provide additional information that can be used by MFish to better assess risk associated with potential adverse effects of harvest, aid industry in the development of their own research programmes, and assist in future assessments of bladder kelp biomass, distribution, and potential yield.

Harvesting strategy and implementation frameworks

- 117 Some submissions express concern about any level of utilisation of attached bladder kelp due to the potential risks surrounding adverse effects of harvesting on localised bladder kelp beds as well as dependent and/or associated species.
- 118 The majority of submissions did not support uncontrolled harvest, and a number of submissions highlighted the need for a pre-established management plan, sustainable harvesting strategy, or other harvest (input) controls before any TAC was set or considered. Other submissions consider the introduction and setting of any TAC for attached bladder kelp should be postponed until suitable management strategies (management framework and harvesting strategies) are implemented to enable TACs to be set at an appropriate level that is viable for economic development.
- 119 MFish agrees that management of the bladder kelp fisheries by output controls alone will not effectively manage potential adverse effects of harvesting on localised kelp beds or associated and/or dependent species across smaller spatial and temporal scales. As noted in the previous section, relying on output controls would also likely restrict the amount of utilisation provided.

120 Submissions provided a number of harvest management measures considered suitable to mitigate potential risks associated with harvest. Consequently, MFish consulted on some of the proposed harvest management measures and potential implementation frameworks.

HARVEST MANAGEMENT MEASURES

121 MFish considers that management of the bladder kelp fisheries by output controls alone will not effectively manage potential adverse effects from harvesting³³ without significantly restricting the amount of utilisation provided. As a consequence, MFish consulted on the following additional management controls.

Summary of Proposed Management Options

Option 1: Maintain the *status quo* and do not institute any additional harvest management measures.

Option 2: Implement one or more of the following harvest management measures:

- a) **Maximum cutting depth** - Institute a maximum cutting depth of no more than 1.2 metres;
- b) **Finer spatial scale reporting** – Require the latitude and longitude location of each harvested kelp bed to be reported
- c) **Maximum canopy removal** - Allow no more than 50% of any one kelp bed's canopy biomass to be harvested over a period of less than 6 months;
- d) **Maximum canopy harvesting frequency** – Require that no one area (i.e. kelp bed) may be harvested more than twice in one year; and
- e) **Maximum canopy harvest width** - Constrain harvesting of the canopy biomass to strips no greater than 5 metres in width.

122 If the harvest management measures outlined under Option 2 were supported in full, or in part, then MFish proposed implementation occur under one of the following ways:

Option A: Implement the harvest management measures by way of the Chief Executive using his powers under s 190 of the Act, as well as the issuance of a *Gazette* Notice under s 11 of the Act.

Option B: Implement the harvest management measures using voluntary industry mechanisms, such as a Memorandum of Understanding (MOU) or agreed-to Code of Practice (COP) agreed among all potential quota holders.

Option C: Implement the harvest management measures using a combination of regulation and voluntary industry mechanisms.

Consultation

123 MFish released the IPP for six weeks of public consultation on 11 June 2010. The IPP was published on the MFish external website and sent to persons and organisations with an interest in review of fisheries' sustainability measures, and

³³ Ibid no. 26.

those having an interest in bladder kelp specifically; including tangata whenua, and environmental, recreational and commercial sector stakeholders.

Submissions Received

124 MFish received nineteen submissions from:

- Mark Armstrong (Armstrong)
- Chatham Islands Enterprise Trust (CIET)
- Department of Conservation (DOC)
- East Otago Taiapure Management Committee (EOTMC)
- Environment Canterbury Regional Council (ECRC)
- Graham Harris (Harris)
- Hokotehi Moriori Trust (HMT)
- Kāti Huirapa Rūnaka I Puketeraki (Puketeraki)
- Graham Metzger (Metzger)
- New Zealand Seafood Industry Council Ltd. (SeaFIC)
- Ngati Mutunga O Wharekauri Asset Holding Co. Ltd. (Ngati Mutunga)
- option4
- Pā Tangaroa – Customary Fisheries Forum (Pā Tangaroa)
- Katja Schweikert (Schweikert)
- Seaweed Association of New Zealand (SANZ)
- Sea-Right Investments Ltd. (Sea-Right)
- Southern Pacific Minerals Ltd. (SPML)
- Te Ohu Kaimoana Trustee Ltd. (Te Ohu)
- Robert Win (Win)

Summary of Submissions

125 Seven of the nineteen submissions support Option 2:

- a) Te Ohu supports implementation via Option B (voluntary mechanisms). Te Ohu considers there is no point in locking in management specifications before industry has had time to test and develop what has been applied in other countries. They consider the most adaptive management approach would fall under a voluntary mechanism.
- b) Six submissions [Armstrong, DOC, option4, SANZ, Sea-Right, and SPML] support implementation via Option C (a combination of voluntary and regulatory mechanisms). Only Sea-Right specifies which measure (i.e. maximum cutting depth) should be implemented via regulation, however SPML also indicate their support for a maximum cutting depth. option4 (on behalf of itself, Hokianga accord, the mid-north iwi fisheries forum, and NZ Sport Fishing) support the proposed measures but reiterate their concern regarding any extensive commercial harvesting considering bladder kelp's high ecological, social and cultural values.

126 SeaFIC considers that commercial interests have clearly indicated their intention to develop the fishery in a manner that is consistent with the harvest management measures proposed. SeaFIC considers the implementation of these measures by regulation should be a tool of last resort, particularly in developmental fisheries with very few quota owners. They consider a voluntary approach enables a more adaptive response as opposed to regulatory control. SeaFIC supports development of an agreement (e.g. MOU) with MFish once quota has been allocated, and considers there to be adequate time for full development of such agreements before

harvest is initiated. SeaFIC notes that if MFish considers progress on such an agreement among quota-holders to be unsatisfactory MFish has the option to then impose regulations under s 11 of the Act.

- 127 Pā Tangaroa supports in principle the harvest management measures proposed, but has additional concerns they consider should be formally addressed prior to the stocks entering the QMS. Pā Tangaroa considers research specific to the Chatham Islands should be undertaken before a TAC is set and any harvest management measures implemented under a 'developmental phase' (re: growth rates, effects of harvest, sustainable harvest methods). They also consider a comprehensive management plan should be implemented prior to introduction and a monitoring programme that would be linked to phased increases in TACCs when certain criteria have been reached.
- 128 Ngati Mutunga, with support from CIET, does not support implementation of any harvest management measures under the TACs originally proposed for KBB4G (Table 1, Options 3 and 4). They refer to the MOU originally submitted by Te Ohu during consultation on TACs that outlines a proposed harvest strategy under their preferred TAC option of 1000 t for KBB4G.
- 129 Four submissions [EOTMC, Puketeraki, Schweikert, and Win] oppose all of the options presented. EOTMC, with support from Puketeraki, do not believe any of the options provide for the protection or even sustainable harvest of bladder kelp forests. Schweikert does not consider the research by Pirker³⁴ should be extrapolated to serve a nation-wide harvest because of the differences in bladder kelp productivity in wave-sheltered versus exposed marine environments. Win disagrees with MFish's consideration of the proposed management measures as they are taken from research that was supported by a stakeholder with commercial interests in bladder kelp.
- 130 Four submissions [ECRC, Harris, HMT, and Metzger] do not indicate support for any of the options proposed. ECRC opposes Option 1, but considers more thought is necessary to properly assess the proposed measures under Option 2 and the potential effects on coastal processes (e.g. erosion).

Assessment of Harvest Management Measures

Option 1 – Status quo

- 131 Maintaining the status quo would result in no additional harvest management measures for the bladder kelp fisheries being implemented prior to setting of the TAC for the 2010/2011 fishing year. Under this option, the TAC becomes the sole management tool for ensuring sustainability of each stock, and management of potential adverse effects from harvesting on localised kelp beds, and associated and/or dependent species.
- 132 The majority of submissions do not support introducing KBB3G and KBB4G to the QMS without some additional harvest management measures in place prior to mitigate potential adverse effects from harvesting. A number of submissions consider that even a low level TAC without additional harvest management measures in place could have adverse impacts and/or prevent maximising utilisation benefits.
- 133 In the absence of controls to restrict harvest in finer spatial scales within a QMA, there is a risk that a large TAC could result in localised depletion of beds within a QMA (and potential localised ecosystem impacts) given the importance of kelp to

³⁴ Ibid no. 9.

near shore ecosystems. Localised depletion could result in adverse environmental impacts if depletion of beds occurs in area where they form a habitat of significance for fishery management and/or leads to impacts on associated species. MFish notes that serial localised depletion of kelp beds could lead to increased QMA-level sustainability risks.

- 134 The risks of localised adverse effects on kelp beds and associate and/or dependent species arising from poor harvesting practices or lack of harvest management measures is partially dependent on the level of TAC chosen for each stock. Risks of localised adverse effects are greatest if TACs are set at the higher levels without additional harvest management measures in place.
- 135 Maintaining the status quo will provide the greatest amount of flexibility for commercial harvesters to develop their own harvesting strategies and undertake sustainable commercial harvest as they see fit to maximise utilisation benefits and value. MFish considers the level of risk of harvesters not following best practice to be low in the short-term, but largely dependent on the number of harvesters that enter the fishery following QMS introduction and the level of utilisation provided. Poor harvesting practices can result in reduced yield from the kelp beds, poor regrowth, and negative impacts on other economically important commercial species (e.g. paua, kina).
- 136 MFish considers the status quo impedes the management goals for the bladder kelp fishery and sees benefit in implementing some additional harvest management measures to mitigate associated risks of harvesting. Using TAC setting as the primary tool for ensuring the functioning and sustainability of attached bladder kelp does not mitigate potential risks, and may constrain utilisation opportunities, thereby reducing potential economic, social and cultural benefits from the fishery.

Option 2 – Adoption of Harvest Management Measures

- 137 Under Option 2 the IPP outlined a range of potential harvest management measures to manage risk associated with harvesting. There were mixed views in submissions regarding the potential effectiveness of each proposed measure. MFish also acknowledged in the IPP that there were substantial practical issues relating to the implementation, monitoring and enforcement of each of these measures, making some of them untenable at this time. After consideration of points raised in submissions, MFish proposes that Maximum cutting depth and Finer spatial scale reporting should be implemented from 1 October 2010.
- 138 Other options considered (including Maximum canopy removal, Maximum canopy harvest frequency, and Maximum canopy harvest width) are problematic to implement given current information and require further assessment in the developmental phase of the fishery to be effective in the New Zealand context. These measures are better implemented through voluntary mechanisms that enable a more adaptive management response to changes in bladder kelp bed biomass, productivity, growth and its vulnerability to other environmental stressors, and should be considered by industry post-QMS introduction.

Maximum cutting depth

- 139 The IPP outlined a proposal to impose a maximum cutting depth of 1.2 m. This measure would protect the base of the plant (where the reproductive structures are located) and prevent whole removal of plants, enabling continuous growth of juvenile fronds found below the cutting depth and protecting against invasions of other seaweed species to the same habitat. Restricting commercial harvest of bladder kelp to the canopy would also reduce the potential establishment and proliferation of

Undaria in localised areas where harvest of bladder kelp occurs. Constraining harvest to the canopy would safeguard harvesters' utilisation opportunities of the attached bladder kelps as this will enable regrowth and protect reproductive capacity to maximise recovery of the beds post-harvest.

- 140 The majority of submitters considered restricting harvest to the canopy a key management principle that should be formally adopted by all harvesters to ensure sustainable utilisation. Other submissions noted concerns about the 1.2 m measurement and whether that measurement falls from the sea surface or the base of the plant. These submitters consider that in areas where bladder kelp beds are located in shallow water, or experience extreme tidal effects (e.g. 2 m), the entire plant could be removed. Additionally, bladder kelp beds that are subject to turbid waters may experience slower post-harvest recovery from reduced light penetration to the base hindering growth. Schweikert considers that cutting the canopy would result in less energy being directed to reproduction because energy would instead be diverted to re-growth of the fronds below the cutting depth.
- 141 Regulated cutting depths are used by the two largest and longest-running bladder kelp fisheries (in California and Mexico). MFish acknowledges there may be situations or areas where this measure is less effective, particularly if the majority of a plant is exposed to harvest at low tide or spring low tide, or where turbid waters slow post-harvest recovery. However, MFish considers this measure would be effective in reducing the overall impact of harvesting on most bladder kelp beds. MFish considers harvesting is most likely to occur where the beds are deep enough for this measure to be effective. MFish also considers there is sufficient industry incentive to encourage rapid post-harvest recovery to ensure maximum canopy development over a shorter timeframe. MFish would review this measure if new information suggested changes were necessary to preserve plant structure and productivity. MFish considers this measure is critical to support any sustainable harvest strategy.

Implementation

- 142 MFish proposes to regulate harvest to no more than 1.2 m below sea surface similar to the regulation used in the California fishery. Under this more generic approach, MFish would work with industry to ensure they are aware of their requirements and how these operations are to be carried out in relation to those requirements.
- 143 An alternative approach would be more prescriptive and could constrain how kelp is harvested by hand-gathering and mechanical methods. For example, constraint harvest by hand-gathering to the cutting of plants from the sea-surface only. If harvesters choose to use mechanical equipment, regulation could require that no cutting tool penetrate the sea-surface more than 1.2 m. Monitoring would focus on examining gear to determine whether it is likely to cut at that depth and where possible the accuracy of self-reporting. MFish notes that monitoring beyond this will be limited.
- 144 MFish considers that during initial implementation we can consider the necessary flexibility required by harvesters to develop effective and compliant harvesting methods. The more flexible approach to the regulation relies on a significant amount of voluntary compliance. MFish considers there is likely to be high levels of voluntary compliance given the level of support for the measure in submissions and the likely limited number of quota holders following QMS introduction. Some submissions noted that this approach is current industry practice. However, it should be noted that this approach will be complicated in terms of allowing us to manage our evidential requirements should enforcement action be necessary.

Finer spatial scale reporting

- 145 The IPP outlined a proposal to require the latitude and longitude location of each harvested kelp bed to be reported. This information would help identify spatial variation in abundance and distribution across QMAs and enable monitoring of the distribution of harvesting effort. This information is important when assessing biological productivity, growth, mortality and potential interactions with associated and/or dependent marine species. Fine spatial scale reporting is also useful in the development of stock assessments, particularly where spatial structure of a stock is quite patchy and there is significant heterogeneity in productivity.
- 146 The development of models and assessments that are accurate and more robust enables greater confidence in the assessment of kelp stocks, particularly when considering the significant temporal and spatial population dynamics that occur. Fine scale reporting provides industry with useful information to assess potential yield across spatial various scales and develop harvesting strategies, which may include rotational harvesting programmes to maximise benefits in areas where the beds are most productive.
- 147 SANZ and option4 consider a definition of what is a 'kelp bed' would support this proposed measure. SANZ notes that beds are both spatially and temporally variable, but consider it a valuable exercise to define what constitutes a bed to support finer spatial scale reporting. SANZ and option4 propose that the mapping of bladder kelp beds within KBB3G and KBB4G be required as a part of harvesting and catch reporting, where individual permit holders map out the spatial extent of each bed and where they intend to harvest from. Spatial mapping information could be used to determine recovery of harvested beds and would support the proposed harvest management measure regarding finer spatial scale reporting. EOTMC consider that better reporting would not prevent extensive harvesting in bladder kelp beds of outstanding value.
- 148 MFish proposes to work with industry on formulating such a definition of a kelp bed once quota has been allocated. MFish considers that it is premature to implement a spatial mapping requirement until industry has the opportunity to consider the most robust approach, a standardised process, and associated costs.
- 149 In the interim, MFish considers implementation of a finer spatial scale reporting framework critical to identifying localised areas where harvest is being concentrated and how much kelp was being removed. Fine spatial scale reporting is useful in the development of a number of management strategies, both industry and government led, and enables MFish to assess different management strategies to ensure that kelp stocks are sustained at levels that provide for current and future use to maximise benefits.

Implementation Framework

- 150 The harvest management measures outlined under Option 2 could be mandatory (Option A), voluntary industry mechanisms (Option B), or a combination of regulatory and voluntary industry mechanisms (Option C).
- 151 The majority of submissions that commented specifically on implementation supported Option C, a combination of regulatory and voluntary industry mechanisms. However, only one submission cited what measure(s) should be implemented via regulation (i.e. Maximum cutting depth).
- 152 Te Ohu considers any harvest management measures should be implemented under

a voluntary mechanism (Option B). SeaFIC considers the potential ecosystem effects of bladder kelp harvest to be over-emphasised, particularly given additional harvesting controls that could be implemented. However, both SeaFIC and Te Ohu consider additional management controls should be developed after allocation of quota and under a voluntary mechanism that allows for a more adaptive risk management approach. SeaFIC notes that MFish has the option to impose regulations at a later date if industry's approach is considered unsatisfactory.

- 153 In general MFish has a preference for implementation of harvest strategies via voluntary agreement, where this agreement can provide sufficient surety that the measure(s) will be applied consistently and on an ongoing basis. In some cases the complexity of the measures themselves lends them to application by industry arrangement rather than Government regulation (because they would be too costly to ensure compliance if there was not widespread voluntary agreement to apply the measures).
- 154 While MFish considers all of the measures discussed above would reduce the risk of adverse effects from harvesting attached bladder kelp, a number of the measures fit better under a voluntary industry-driven strategy (i.e. *Maximum canopy removal*, *Maximum canopy harvest frequency*, and *Maximum canopy harvest width*). These measures cannot be effectively enforced at this time because there is insufficient information available regarding location and size of bladder kelp beds. MFish also acknowledges the difficulty in developing such an arrangement before quota-holders have been identified (some of the quota for attached bladder kelp in KBB3G will be made available to the highest bidder). The question is whether there is benefit in regulating some measures in advance of any industry agreement.
- 155 On balance, given the potential constraint to utilisation necessary to manage the risk of adverse effect without additional management controls MFish considers there is benefit in implementing those measures that will be most effective in reducing the risk of adverse effects from harvesting and will impose least cost on industry.
- 156 Based on the analysis above MFish recommends that you implement a *Maximum cutting depth* via *Gazette* notice under s 11(4) of the Act. To do so, you must take into account the matters outlined in ss 11(1) and 11(2) of the Act, which are discussed in the previous chapter under *Sustainability Measures – Considerations* (beginning paragraph 49).
- 157 Sea-Right (the current principle harvester) indicated their support for the regulation of a maximum cutting depth of 1.2 m. SPML concur with implementation of a cutting depth of 1.2 m maximum but did not specify whether this should occur under MFish regulation. However, SPML did note their intention to harvest with a sickle blade mower set a 1.2 m to ensure compliance.
- 158 MFish also seeks your views on the Chief Executive using his powers under s 190 of the Act to require *Finer spatial scale reporting*. MFish considers regulation of this measure necessary to provide baseline information regarding harvesting effort and biomass removal across various spatial and temporal scales because of the discrete nature of bladder kelp beds.

Implementation of other measures

- 159 MFish proposes to work with quota-holders following introduction into the QMS to develop of a voluntary MOU between MFish and industry as a mechanism to implement further measures to reduce the risks associated with the potential adverse effects of harvesting.

- 160 A number of submissions consider that likely quota-holders in KBB4G would cooperate to implement a suitable harvest strategy. They contend most of these groups had interests in other fisheries (e.g. rock lobster, paua) that would provide sufficient incentive for a cautious and robust development of the industry. MFish acknowledges that Te Ohu has provided a MOU agreed to by Hokotehi Moriori Trust, Ngati Mutunga o Wharekauri Iwi Trust, and Chatham Island Enterprise Trust that outlined an agreed to set of harvesting protocols to mitigate potential adverse effects of harvesting. The MOU includes the harvest management measures proposed under Option 2. Te Ohu notes that the MOU is formally endorsed by all but one of the potential future quota owners in KBB4G, but that individual has separately endorsed the majority of the recommendations outlined in the MOU. MFish considers this MOU provides a good basis for development of a formal harvesting strategy.
- 161 MFish also acknowledges additional support from SANZ, SeaFIC, and Sea-Right, to develop an MOU or similar among quota-holders within each stock (once allocated) through the formal establishment of an industry association. MFish notes these submissions indicate a strong willingness of industry to develop a harvest strategy that maximises value from the resource within environmental limits.

Other Management Measures Proposed

- 162 Protection of some kelp beds: A number of submissions consider that some bladder kelp beds should be protected from any harvest due to outstanding ecological and/or cultural significance. Proposed areas included kelp beds north of Otago, those found in the East Otago Taiapure, Cape Campbell, and any within proposed Mataitai in the Ngāi Tahu takiwā be established as closed areas. Te Ohu support Ngāi Tahu request that no commercial harvesting of kelp beds occurs within important mahinga kai areas. Some stakeholders expressed concern over your ability to close the fishery or an area to harvest if it is deemed to be unsustainable.
- 163 Te Ohu supports the kelp industry working with stakeholders and tangata whenua to identify sensitive areas where commercial kelp harvesting may be inappropriate. Te Ohu (and under the recommendations in the MOU) recommend the use of pilot areas where limited harvest can occur until there is robust evidence that shows harvest is sustainable and not effecting associated stocks. SANZ and option4 both recommend that the use of control beds (where no harvest would occur) would assist with monitoring potential effects of harvest in localised areas.
- 164 MFish considers the use of control beds could be a useful tool for both monitoring and protection of some beds. Until more is known about the distribution of bladder kelp MFish considers it is premature to regulate closed areas. MFish will work with industry and other stakeholders to identify areas of outstanding ecological and/or cultural significance where harvest may be avoided either through voluntary or regulatory means.
- 165 Implementation of smaller management areas: MFish agrees with several submissions that attached bladder kelp stocks should be managed on a small spatial scale due to its vulnerability to localised over-harvesting, and its highly variable abundances and spatial productivity. MFish considers that at this time QMAs provide sufficient boundaries within which quota owners and stakeholders can practice small-scale management. MFish will monitor this approach and determine whether smaller stock management over time is best implemented using fisheries plans, alteration of QMAs and other measures within the Act.
- 166 Implementation of a rotational harvest strategy: MFish considers these stocks well

suited to being managed rotationally, and this strategy can help reduce disruption to the understorey of the beds, prevent localised depletion issues and maximise utilisation opportunities. However, rotationally managed stocks generally require annual biomass estimates that would determine the maximum canopy biomass that could be harvested (similar to a CAY), to respond to annual fluctuations across various spatial scales. This management strategy involves annual biomass surveys and yield calculations that can be costly. MFish considers it premature to implement such a strategy prior to KBB3G and KBB4G entering the QMS and allocation of quota, but will work with stakeholders if they wish to proceed in this direction.

- 167 Implementation of seasonal controls: Growth rates of bladder kelp beds in New Zealand are strongly seasonal and vary along the coast. The time of year harvesting occurs will have a strong influence on post-harvest recovery and needs to be considered. There is currently insufficient information to accurately describe growth rates in all areas; however there is information available for some locations (e.g. Otago Harbour, Akaroa Harbour) that will be useful in the development of harvest protocols. MFish will work with industry to identify this information and provide support in the development of harvest strategies that maximise bed recovery between harvests.
- 168 Industry council and area based management companies: The implementation of an industry council or local area-based management companies is supported by MFish. A number of submissions have indicated their support for the formation of an industry structure to manage the fishery on finer spatial scales. Additionally, SANZ and option4 have indicated their support for implementation of a “one area/one harvester” approach to seaweed harvesting. MFish notes that this type of framework is not possible under the Act but support industry investigation of whether it is a viable approach appropriate to maximise value for all quota-holders while mitigating adverse effects of harvesting.

Conclusion and Summary of Recommendations

Conclusions

- 169 MFish recommends you consider the potential utilisation benefits associated with implementing a higher TAC versus the potential increase in adverse effects from harvesting (Table 4). MFish recommends that you consider additional harvest management measures to mitigate these risks. Alternatively, you may implement a lower TAC, which would reduce potential adverse effects from harvesting but constrain utilisation until quota-holders were identified and given the opportunity to develop a formal harvesting strategy post-QMS introduction.

Table 4: Level of risk associated with potential adverse effects of harvesting on localised areas and associated and/or dependent species in the absence or presence additional harvest management levels at each TAC option proposed

Stock		TAC (tonnes)	Level of risk associated with adverse effects of harvesting	Required harvest management tools to mitigate risk	Level of risk with additional harvest management measures
KBB3G	Option 1	1866	Highest	Regulate maximum cutting depth and require finer scale reporting; support additional voluntary mechanisms	Moderate-High
	Option 2	1238	High		Moderate
	Option 3	377	Moderate	Low	
	Option 4	41.2	Low	Rely solely on voluntary mechanisms	Low
	Option 5	18.2	Low	Low	
KBB4G	Option 1	411	Highest	Regulate maximum cutting depth and require finer scale reporting; support additional voluntary mechanisms	Moderate
	Option 2	274	Moderate		Low
	Option 3	26.2	Low	Rely solely on voluntary mechanisms	Low
	Option 4	2.2	Low	Low	

170 Based on best available information MFish recommends that you:

- a) set the TAC and sector allowances for KBB3G as laid out in Option 2 (Table 1);
- b) set the TAC and sector allowances for KBB4G as laid out in Option 2 (Table 1);
- c) set the annual and interim deemed value rates at \$1.00 per kg and \$0.50 per kg, respectively for both stocks;
- d) implement a Maximum cutting depth of 1.2 m via Gazette notice under s 11(4) of the Act, and;
- e) note that the Chief Executive would also exercise his powers under s 190 of the Act to require Finer spatial scale reporting.

171 This is because:

- a) Bladder kelp forests are amongst the most productive marine communities in New Zealand and play a significant ecological role within the marine ecosystem.
- b) Bladder kelp beds are sensitive to changes in environmental factors and naturally experience large fluctuations in abundance both spatially and temporally.
- c) Current estimates of total biomass or sustainable yield are unavailable for the entire KBB3G or KBB4G areas and stock status and potential yield were determined using historical information.
- d) Although stock status is historical both KBB3G and KBB4G are considered to be

near virgin biomass levels and are likely to sustain significantly higher catch levels than present.

- e) Current commercial catch levels are low and reflect the restrictive commercial access arrangements to attached bladder kelp under the previous management regime. Higher commercial catches are anticipated under QMS management in the long-term.
- f) Attached bladder kelp is generally not harvested by non-commercial fishers.
- g) There is strong support to proceed with a cautious proving up of the fishery levels until robust stock assessment information becomes available and appropriate harvesting strategies can be developed.

Recommendations

KBB3G

172 MFish recommends that, for the KBB3G fishery, for the fishing year commencing on 1 October 2010, you:

EITHER

a) **Agree** to set a TAC of 1866 t and within this:

- i) **Set** a customary allowance of 0.1 t;
- ii) **Set** a recreational allowance of 0.1 t;
- iii) **Set** an allowance for other sources of fishing related mortality of 1 t, and;
- iv) **Set** a TACC of 1864.8 t.

OR

b) **Agree** to set a TAC of 1238 t (MFish preferred option) and within this:

- i) **Set** a customary allowance of 0.1 t;
- ii) **Set** a recreational allowance of 0.1 t;
- iii) **Set** an allowance for other sources of fishing related mortality of 1 t, and;
- iv) **Set** a TACC of 1236.8 t.

OR

c) **Agree** to set a TAC of 377 t and within this:

- i) **Set** a customary allowance of 0.1 t;
- ii) **Set** a recreational allowance of 0.1 t;
- iii) **Set** an allowance for other sources of fishing related mortality of 1 tonne, and;
- iv) **Set** a TACC of 375.8 t.

OR

d) **Agree** to set a TAC of 41.2 t and within this:

- i) **Set** a customary allowance of 0.1 t;
- ii) **Set** a recreational allowance of 0.1 t;
- iii) **Set** an allowance for other sources of fishing related mortality of 1 t, and;
- iv) **Set** a TACC of 40 t.

OR

e) **Agree** to set a TAC of 18.2 t and within this set:

- i) **Set** a customary allowance of 0.1 t;
- ii) **Set** a recreational allowance of 0.1 t;
- iii) **Set** an allowance for other sources of fishing related mortality of 1 t, and;
- iv) **Set** a TACC of 17 t.

KBB4G

173 MFish recommends that, for the KBB4G fishery, for the fishing year commencing on 1 October 2010, you:

EITHER

a) **Agree** to set a TAC of 411 t and within this:

- i) **Set** a customary allowance of 0.1 t;
- ii) **Set** a recreational allowance of 0.1 t;
- iii) **Set** an allowance for other sources of fishing related mortality of 1 t, and;
- iv) **Set** a TACC of 409.8 t.

OR

b) **Agree** to set a TAC of 274 t (*MFish preferred option*) and within this:

- i) **Set** a customary allowance of 0.1 t;
- ii) **Set** a recreational allowance of 0.1 t;
- iii) **Set** an allowance for other sources of fishing related mortality of 1 t, and;
- iv) **Set** a TACC of 272.8 t.

OR

c) **Agree** to set a TAC of 26.2 t and within this:

- i) **Set** a customary allowance of 0.1 t;
- ii) **Set** a recreational allowance of 0.1 t;
- iii) **Set** an allowance for other sources of fishing related mortality of 1 t,

and,

- iv) **Set** a TACC of 25 t.

OR

d) **Agree** to set a TAC of 2.2 t and within this:

- i) **Set** a customary allowance of 0.1 t;
- ii) **Set** a recreational allowance of 0.1 t;
- iii) **Set** an allowance for other sources of fishing related mortality of 1 t, and;
- iv) **Set** a TACC of 1 t.

KBB3G and KBB4G

174 MFish recommends that, for the KBB3G and KBB4G fisheries, for the fishing year commencing on 1 October 2010, you:

EITHER

- i) **Agree** to set an annual deemed value of \$1.00 per kg (excluding GST) for both KBB3G and KBB4G (*MFish preferred option*), and;
- ii) **Agree** to set an interim deemed value of \$0.50 per kg (excluding GST) for both KBB3G and KBB4G (*MFish preferred option*);

OR

- iii) **Agree** to set an annual deemed value of \$4.00 per kg (excluding GST), and
- iv) **Agree** to set an interim deemed value of \$2.00 per kg (excluding GST);

AND

- v) **Agree** that standard differential deemed value rates are used in KBB3G and KBB4G but no overfishing thresholds be set at this time;

AND

- vi) **Agree** to implement a maximum cutting depth of 1.2 m;

AND

- vii) **Note** that the Chief Executive will require finer spatial scale reporting;

AND

- viii) **Support** development of a Memorandum of Understanding, or similar, between MFish and industry quota-holders to develop a voluntary harvesting strategy.