



# Review of Sustainability Controls for the Coromandel Scallop Fishery

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Requests for further copies should be directed to:

Publications Logistics Officer  
Ministry for Primary Industries  
PO Box 2526  
WELLINGTON 6140

Email: [brand@mpi.govt.nz](mailto:brand@mpi.govt.nz)

Telephone: 0800 00 83 33

Facsimile: 04-894 0300

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# 1 Submission Information

MPI welcomes written submissions on any or all of the proposals contained in the Consultation Document. All written submissions must be received by MPI no later than 5pm on 11 February 2016.

Written submissions should be sent directly to:

Inshore Fisheries Management  
Ministry for Primary Industries  
P O Box 2526  
Wellington 6011

or emailed to [FMSubmissions@mpi.govt.nz](mailto:FMSubmissions@mpi.govt.nz)

## 1.1 OFFICIAL INFORMATION ACT 1982

All submissions are subject to the Official Information Act and can be released (along with personal details of the submitter) under the Act. If you have specific reasons for wanting to have your submission or personal details withheld, please set out your reasons in the submission. MPI will consider those reasons when making any assessment for the release of submissions if requested under the Official Information Act.

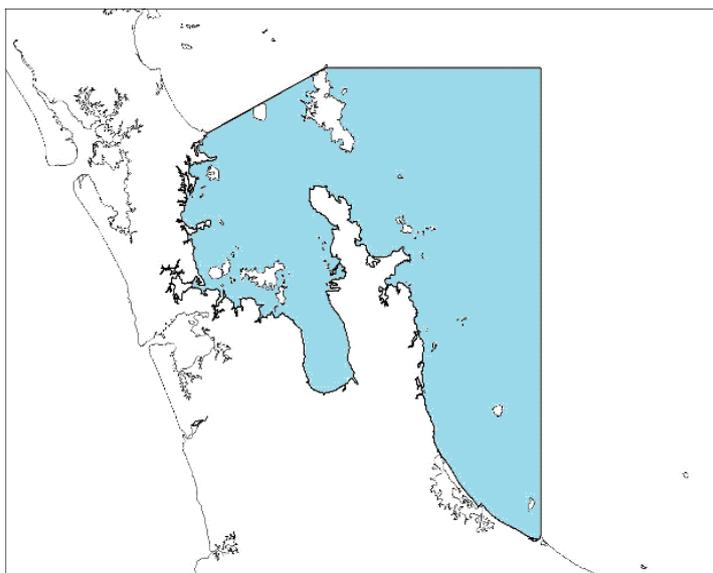


Figure 1: Quota Management Area (QMA) for the Coromandel Scallop Fishery (SCACS)

## 2 Executive Summary

The Ministry for Primary Industries (MPI) is seeking information and views from tangata whenua and stakeholders to inform a review of catch limits for the SCACS fishstock (scallop in the SCACS quota management area, see Figure 1).

In 2013, the Minister for Primary Industries (the Minister) increased the Total Allowable Catch (TAC) for SCACS from 47 to 131 tonnes to provide for increased utilisation. The Total Allowable Commercial Catch (TACC) was increased from 22 to 100 tonnes and recreational and Maori customary allowances were increased from 7.5 to 10 tonnes each.

Information that formed the basis for the TAC decision included the discovery of a significant bed of scallops in 2011, which was surveyed as part of the SCACS biomass survey in 2012. Commercial fishers have not fished that scallop bed since 2013 and report that it is no longer there (supported by fine-scale fishing data). The risks associated with maintaining the current TAC, despite the likely change in fishery biomass, are partly mitigated by the operation of voluntary and other measures in the commercial fishery. However, MPI considers it is necessary to review the TAC to consider whether the current TAC, TACC and allowances adequately ensure sustainability based given best available information. An updated biomass survey has not been undertaken and is not available to inform this review.

MPI proposes the following options for the upcoming fishing year (Table 1):

**Table 1: Proposed Management Settings for SCACS**

Option	Total Allowable Catch (t)	Total Allowable Commercial Catch (t)	Allowances		
			Customary Māori (t)	Recreational	Other sources of fishing-related mortality
Option 1 (Status Quo)	131	100	10	10	11
Option 2	81	50	10	10	11

## 3 Purpose

### 3.1 NEED FOR ACTION

The TAC for the Coromandel scallop (SCACS) fishstock was increased in 2013 in accordance with the Fisheries Act 1996 (“the Act”) to enable utilisation opportunities. These increased catch limits may no longer be supported by up-to-date information. In a fishery highly valued and utilised by customary, recreational and commercial fishers it is important that management settings be reviewed and updated to reflect the current situation.

### 3.2 MANAGEMENT APPROACH

SCACS is a Group 2 stock within the draft National Fisheries Plan for Inshore Shellfish. Objectives for Group 2 stocks include enabling annual yield from the fishery to be maximised, while maintaining the stock size at or above the level required to ensure sustainability and the spawning stock biomass.

The TAC for SCACS can be varied under section 13 of the Fisheries Act 1996. Section 13(2) of the Act specifies requirements for setting a TAC where a reliable estimate of the current biomass of the stock and the level of biomass that can produce the maximum sustainable yield ( $B_{MSY}$ ), is known. In cases such as SCACS, where current biomass and  $B_{MSY}$  are not known, section 13(2A) of the Act provides for the Minister 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, the  $B_{MSY}$  level.

In this fishery there is also the ability to adjust the TAC within a fishing year. SCACS is included on Schedule 2 of the Act which lists stocks whose abundance is variable, and allows for an in-season management adjustment approach. Such increases apply only for that year. This paper considers the ‘baseline’ TAC and does not relate to an in-season increase.

Between 2002 and 2012 SCACS, was managed using a low baseline TAC and an annual in-season increase informed by annual survey information. Over the past four years a more cost-effective management approach has been sought, taking into account that significant fluctuations in the stock size occur over timescales that may be longer than a single year.

The new management approach, which is still being refined, aims to reduce the frequency of biomass surveys and management reviews but increase control on the commercial fishery through fine-scale analysis of commercial catch activities. A voluntary scheme known as the “CPUE-limit rule” has been operating for the past five years and involves the cessation of commercial fishing when an area is not producing specified catch rates. As CPUE is often not a reliable estimate of abundance for scallop fisheries, the effectiveness of the CPUE-limit rule in ensuring the sustainability of the SCACS stock is uncertain.

Further assessment of this management approach, including determination of the frequency of biomass surveys, will occur following an independent workshop in March 2016 consisting of a panel of expert fisheries scientists. The role of the expert panel will be to review how effectively New Zealand is assessing the status of the scallop stocks and, as required, make recommendations for improvements to data collection, stock assessment modelling methods and development of target and limit reference points. Actions arising from this review will be considered later in 2016 and will inform the future management approach for scallops.

In the interim, this management review recognises the initiatives underway but notes the uncertainties in terms of current status of the stock due to no biomass surveys being undertaken since 2012. In these circumstances it is appropriate to review the TAC under section 13(2A) of the Act.

## 4 Background Information

### 4.1 BIOLOGICAL CHARACTERISTICS OF SCALLOPS

Scallops are found in a variety of coastal habitats, but particularly in semi-enclosed areas where circulating currents are thought to retain larvae. Scallops are largely sessile but can move actively, mainly in response to predators.

Scallops become sexually mature at a size of about 70 mm shell length. They are extremely fecund and may spawn several times each year. The very high fecundity of this species, and likely variability in the mortality of larvae and pre-recruits, leads to great variability in annual recruitment. This, combined with variable mortality and growth rate of adults, leads to scallop populations being variable, especially in areas of rapid growth where the fishery may be supported by only one or two year classes.

The growth of scallops within the Coromandel fishery is variable among areas, years, seasons and depths, and probably among substrates.

Further information on the biological characteristics of scallops is provided in Appendix One.

### 4.2 COMMERCIAL FISHERY

The greatest quantities of scallops taken in SCACS are caught in the commercial fishery. Commercial fishing is conducted by a fleet of around seven vessels within a number of discrete beds around Little Barrier Island, east of Waiheke Island, at Colville, north of Whitianga (to the west and south of the Mercury Islands), and in the Bay of Plenty (principally off Waihi, and around Motiti and Slipper Islands).

There are significant areas of commercial restrictions, and minimum legal size limits and fishing seasons for the commercial fishery. The fishing year operates from 1 April to 31 March, but the commercial fishing season only runs from 15 July to 21 December each year. Commercial fishers operate five days a week during the season and have voluntary daily catch limits.

In 2011, commercial fishers discovered a new bed within the Hauraki Gulf containing high densities of large scallops. This new, deeper (45–50 m water depth) region of the fishery was utilised between 2011 and 2013, but fishers report the bed has since died off. This is supported by fine-scale catch-per-unit-effort (CPUE) information collected by the fleet and used to guide the voluntary CPUE- limit rule management approach.

The CPUE limit rule is a voluntary management program run by the commercial fishers. The rule responds to changes in each vessel’s CPUE and the ratio of scallops less than the minimum legal size (MLS). If catch per hour falls below the previously-agreed limit and/or the ratio of scallops less than the MLS per catch exceeds the previously-agreed limit, then statistical reporting areas, or smaller sub-statistical areas can be closed for the remainder of the season.

Commercial catches have averaged approximately 62 tonnes (meatweight – adductor muscle with roe attached) per year since introduction to the QMS. The TACC was adjusted in-season annually up until 2013 and has since been set at 100 tonnes (Figure 2).

All commercial fishing is by dredge, with fishers preferring self-tipping “box” dredges (1.5 to 2.4 m wide, fitted with a rigid tooth bar on the leading bottom edge) to the “ring bag” designs used elsewhere in New Zealand.

Catch and catch rates from the Coromandel fishery are variable both within and among years, a characteristic typical of scallop fisheries worldwide.

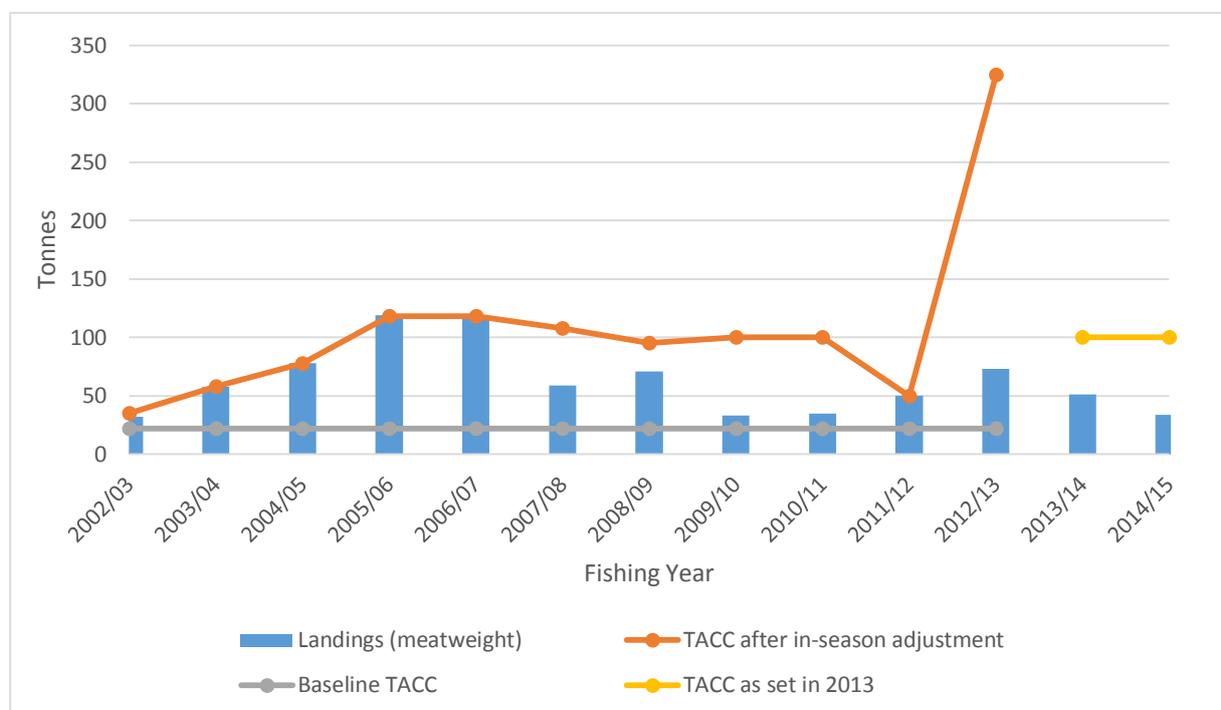


Figure 2: Landings and catch limits for SCACS from 2002–03 to 2012–13. TACC is the total allowable commercial catch, and all weight is meatweight.

#### 4.3 RECREATIONAL FISHERY

There is a significant recreational interest in scallops in suitable areas throughout the Coromandel fishery, mostly in enclosed bays and harbours. Many of these areas are set aside as non-commercial areas. Scallops are taken by diving using snorkel or scuba, and considerable amounts are also taken using small dredges.

Regulations<sup>1</sup> governing the recreational harvest of scallops from SCACS include a minimum legal size of 100 mm shell length and a restricted daily harvest (bag limit) of 20 per person. A change to the recreational fishing regulations in 2005 allowed divers operating from a vessel to take scallops for up to two nominated safety people on board the vessel, in addition to the

<sup>1</sup> Fisheries (Amateur Fishing) Regulations 2013

catch limits for the divers. Until 2006, the recreational scallop season ran from 15 July to 14 February, but in 2007 the season was changed to run from 1 September to 31 March.

A pilot survey was conducted in 2007–08 to assess the feasibility of estimating the recreational catch from Cape Colville to Hot Water Beach. The study was based on a boat ramp survey using interviewers to collect catch and effort information from returning fishers, and was conducted from 1 December 2007 to 28 February 2008 during the peak of the scallop season. The total estimated harvest during the survey period was 205,400 scallops, with an estimated 23.9 tonnes greenweight harvested (about 3 tonnes meatweight). The estimate of 67 tonnes greenweight (about 8 t meatweight) from the National Panel Survey in 2011–12<sup>2</sup> equates to about 16% of the commercial harvest in the area surveyed in that year. The annual recreational harvest level is likely to vary substantially through time, and be a function of available scallop abundance.

#### 4.4 MĀORI CUSTOMARY FISHERY

Scallops are an important traditional food for Maori and continue to be gathered under provisions for customary fishing.

For those tangata whenua groups operating under the customary fishing regulations<sup>3</sup>, there is a requirement for Tangata Kaitiaki/Tiaki to provide MPI with information on Māori customary harvest of fish. However, some tangata whenua in SCACS are still operating under regulation 50-52 of the Fisheries (Amateur Fishing) Regulations 2013, and it is not mandatory to report permits that are issued. A summary of the information that has been supplied to MPI is provided in Table 2.

Table 2: Summary of customary authorisation information for SCACS

SCACS Fishing year	Quantity approved, by unit type					Actual quantity harvested, by unit type				
	Bag	BIN	Weight (kg)	Number	Unspecified	Bag	BIN	Weight (kg)	Number	Unspecified
2003–04	–	–	600	200	–	–	–	600	200	–
2004–05	–	–	360	50	150	–	–	360	–	–
2005–06	–	–	3	700	50	–	–	0	–	–
2006–07	–	–	–	290	–	–	–	–	180	–
2007–08	–	–	330	630	–	–	–	285	280	–
2008–09	1	10	370	2390	13550	–	4	82	2090	4476
2009–10	–	1	150	1260	15510	–	202	65	1000	4500
2010–11	–	–	675	1800	19700	–	–	190	1400	6785
2011–12	–	–	310	640	25590	–	–	310	0	10270
2012–13	–	3	250	80	29800	–	200	200	80	14904
2013–14	–	–	–	2390	16830	–	–	–	2090	7055

#### 4.5 OTHER SOURCES OF FISHING-RELATED MORTALITY

An allowance is made within the TAC to cover the mortality of fish that results from various factors associated with fishing, but not reported as catch. This can include scallops that escape the gear, but die later. In addition, this allowance covers any component of catch that is unlawfully discarded. Legal-sized scallops caught commercially in SCACS must be landed and must not be returned to the water.

Incidental damage to uncaught or undersize scallops can occur during commercial dredging. The box dredges in use in the Coromandel commercial fishery have been found to be more efficient in the generally sandy conditions prevalent in the fishery than the ring-bag dredges used elsewhere in New Zealand. However, scallops encountered by box dredges have shown

<sup>2</sup> Available at: [http://fs.fish.govt.nz/Doc/23718/FAR\\_2014\\_67\\_2847\\_MAF2010-01.pdf.ashx](http://fs.fish.govt.nz/Doc/23718/FAR_2014_67_2847_MAF2010-01.pdf.ashx)

<sup>3</sup> Fisheries (Kaimoana Customary Fishing) Regulations 1998

modest reductions in growth rate, compared with scallops collected by divers, and quite high mortality (about 20–30% mortality for scallops that are returned to the water. i.e. just under the MLS of 90 mm). Recent field experiments and modelling suggest that dredging reduces habitat heterogeneity and increases juvenile mortality.

Other sources of fishing-related mortality are likely to occur from recreational dredging and illegal take of scallops. MPI does not have reliable estimates of these other sources of fishing-related mortality.

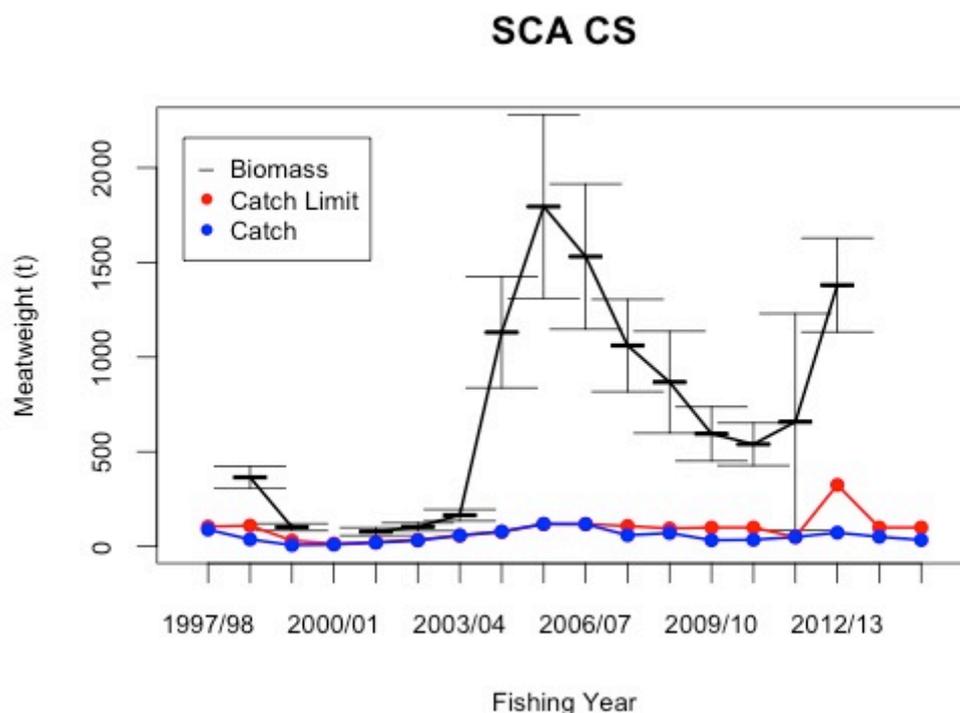
#### 4.6 PREVIOUS REVIEW

The TAC for SCACS was last reviewed in 2013. The review resulted in a TAC increase to take advantage of the large scallop bed discovered in 2011.

The TAC was increased to 131 tonnes, from 48 tonnes. The TACC was increased from 22 tonnes, to 100 tonnes. Maori customary fishing and recreational allowances were increased to 10 tonnes, from 7.5 tonnes each. The allowance for other sources of fishing-related mortality remained at 11 tonnes.

#### 4.7 SCIENCE INFORMATION

Biomass surveys were conducted for SCACS annually from 1998 until 2012, with the exception of 2011 (Figure 3). Estimated recruited biomass (tonnes of meatweight of scallops greater or equal to the commercial MLS of 90mm) in the core areas of the fishery during 1999- 2003 was consistently at or near the lowest on record (78 tonnes in 2001). The estimated recruited biomass then increased to record highs in 2005 (1795 tonnes) and 2006 (1531 tonnes) before decreasing.



**Figure 3: Estimated recruited biomass (scallops 90 mm or more shell length), catch limits, and landings in tonnes meatweight for the SCA CS fishery since 1998. In 2011, no survey was conducted; instead, biomass was estimated by projecting forward from the 2010 survey. No surveys have been carried out since 2012.**

The comprehensive 2012 survey coverage included a new, large area of the fishery in Hauraki Gulf and showed that it held considerable biomass. Recruited biomass has not been estimated in SCACS since 2012 and commercial fishers report that the beds in the new area of the Hauraki Gulf have since gone (supported by fine-scale fishing data).

## 5 Legal Considerations

### 5.1 SETTING MANAGEMENT MEASURES

MPI considers the options presented in this paper are not inconsistent with the requirements under section 13(2A) that the stock should be managed at or above  $B_{MSY}$ , or moving the stock towards or above  $B_{MSY}$  (as discussed in section 3.2 above).

### 5.2 FURTHER CONSIDERATIONS

Section 12(1)(b) of the Act requires that the Minister provide for the input and participation of tangata whenua and have particular regard to kaitiakitanga before setting or varying a TAC. MPI has informed Mai i Nga Kuri a Whareki Tihirau Fisheries Forum (Bay of Plenty)<sup>4</sup> of the proposals and has provided opportunity for engagement. Mandated Iwi Organisations within the Quota Management Area have also been contacted.

When setting or varying the TAC relating to stocks with boundaries intersecting with the Hauraki Gulf Marine Park, the Minister shall have regard to sections 7 and 8 of the Hauraki Gulf Marine Park Act 2000 (HGMPA):

- Section 7 recognises the national significance of the Hauraki Gulf, including its capacity to provide for the relationship of tangata whenua and the social, economic, recreational and cultural wellbeing of people and communities
- Section 8 of the HGMPA sets out the objectives of the management of the Hauraki Gulf, which include the maintenance or, where appropriate, the enhancement of the Gulf for social and economic wellbeing, and its contribution to the recreation and enjoyment, of the people and communities of the Gulf and New Zealand.

MPI considers that the proposed TAC options provide for the above outcomes and are consistent with these sections of the HGMPA.

When making a decision concerning the TAC for a stock under section 13(2A), the Minister must have regard to interdependence of stocks, the biological characteristics (discussed earlier) and any environmental conditions affecting the stock.

Sections 9(a) and (b) also require the Minister to take into account that associated or dependent species be maintained at or above a level that ensures their long-term viability, and that the biological diversity of the aquatic environment should be maintained.

The key environmental interactions associated with the SCACS fishery are discussed below with reference to the likely impacts of the proposed management options.

#### 5.2.1 Seabirds, Mammals, and protected fish

There is no known bycatch of seabirds, mammals or protected fish species from New Zealand scallop fisheries.

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<sup>4</sup> Nga Kuri a Whareki Tihirau Fisheries Forum covers iwi and hapu of the Bay of Plenty coast, between Waiōroto Stream near Waihi Beach in the west to Cape Runaway in the east.

## 5.2.2 Benthic impacts

It is well known that fishing with mobile bottom contact gears such as dredges have impacts on benthic populations, communities, and their habitats. The effects are not uniform, but depend on at least the specific features of the seafloor, the natural disturbance regime, the species present, the type of gear and the frequency it is used. The effects of scallop dredging on the benthos are well-studied, with New Zealand studies (including in SCACS) showing that with increasing fishing intensity there are decreases in the density and diversity of benthic communities and, especially, the density of emergent epifauna that provide structured habitat for other fauna.

# 6 Proposed Response

## 6.1 TOTAL ALLOWABLE CATCH

Section 13(2A) of the Act provides for a TAC to be set that is not inconsistent with the objective of maintaining the stock at or above, or moving the stock towards or above, a level that can produce the maximum sustainable yield. The reference points that have historically guided these decisions for SCACS have been based on the fishing mortality target or reference point ( $F_{0.1}$ ). However the MPI Shellfish Working Group (SFWG) has advised that  $F_{0.1}$  is not a good reference point because of the unreliability of our estimates of natural mortality. The SFWG have advised moving to some value of exploitation rate. The appropriate exploitation rate has not yet been determined for SCACS.

In addition, no up-to-date estimate of biomass is available. Consequently, MPI has limited information to assess the TAC. MPI proposes options that are based on catch limits and patterns in the fishery over a number of years. Within the constraints of the available information, the options satisfy the purpose of the Act and the requirements of section 13(2A). They also take into account that the “CPUE-limit rule” programme mitigates some of the risks, allowing any significant reductions in abundance to be identified and addressed.

Table 3: Proposed Management Settings for SCACS

Option	Total Allowable Catch (t)	Total Allowable Commercial Catch (t)	Allowances		
			Customary Māori (t)	Recreational	Other sources of fishing-related mortality
Option 1 (Status Quo)	131	100	10	10	11
Option 2	81	50	10	10	11

## 6.2 OPTION 1

Under Option 1, the existing TAC would be retained. The TACC and allowances would be retained in line with the *status quo*. Option 1 relies on the voluntary CPUE limit rule that operates within the commercial fishery, alongside other elements of the management framework including area, season and size restrictions, to mitigate risks associated with the current TAC.

This option does not respond to the information suggesting that the large biomass of scallops in the Hauraki Gulf may no longer be there. MPI considers it appropriate to review the TAC to ensure that, based on best available information, it is set at a level that is not inconsistent with the objective of maintaining or moving the stock biomass towards or above  $B_{MSY}$ . Overall, Option 1 is less consistent with this objective than Option 2.

### *Impact*

Option 1 provides the greatest flexibility for commercial fishers to increase their catch should abundance increase or a new scallop bed be discovered. However, catch has been below the level of the current TAC for all but two of the fishing years since SCACS was introduced to the QMS. Catches are likely to remain below the level of the current TAC in the short term, unless new areas of unfished scallops are identified. Therefore, this flexibility is unlikely to be required.

In terms of the environmental and other considerations the Minister must have regard to (refer section 5.2), this option has the potential to increase the intensity of fishing effort and the environmental impacts of dredging, if fishing to the level of TACC occurs. In practise this may not occur due to operation of the CPUE-limit rule.

## 6.3 OPTION 2

Option 2 proposes:

- The TAC be reduced from 131 tonnes to 81 tonnes
- The TACC be reduced from 100 tonnes to 50 tonnes
- The customary Māori customary allowance would remain at 10 tonnes
- The recreational allowance would remain at 10 tonnes
- The allowance for other sources of fishing-related mortality would remain at 11 tonnes.

Option 2 reduces the TAC to respond to information that the current TAC may not be sustainable. It takes a cautious approach to a high value shared fishery in light of:

- information from commercial fishers (supported by fine-scale fishing data) that the overall biomass may have declined as the Hauraki Gulf bed is no longer there;
- the requirement that the TAC, TACC and allowances adequately ensure sustainability based on best available information; and
- an updated biomass survey of the fishery has not been undertaken.

Option 2 aligns the TAC and TACC with recent performance of the fishery. When SCACS was introduced into the QMS in 2002 the TAC was set at 48 tonnes, based on an average annual commercial landing calculation of 22 tonnes. Since then the performance of the commercial fishery has improved. Even excluding the years when the Hauraki Gulf bed was being fished (2011 and 2012), and landings were particularly high, commercial landings over the last 8 years have averaged 47 tonnes.

MPI notes an option to reduce the TAC and TACC further could be considered, but does not have information to support a particular TAC or TACC. In addition, MPI does not favour a management approach whereby a very low baseline TAC is set requiring an annual in-season review to allow commercial utilisation. A more cost-effective management approach is appropriate, that takes into account information suggesting fluctuations in the stock size occur over timescales longer than a single year and can be managed accordingly (refer section 3.2).

The longer term management approach for this fishery will be considered following review of the management approach by the international panel in early 2016. In the interim, MPI consider this review is necessary to ensure the catch limit best ensure sustainability of this highly valuable shared fishery.

No changes are proposed under this option to the Māori customary allowance or recreational allowance as the key change in the stock has been to the Hauraki Gulf bed that is generally inaccessible to non-commercial fishers.

Information to set the allowance for other sources of mortality for SCACS is uncertain. In the absence of additional information MPI proposes that the allowance be retained at the current setting.

### *Impact*

Option 2 may constrain the commercial fishery if biomass increases, or if a new area of unfished scallops is identified. Under these circumstances a further adjustment of the TAC and TACC may be considered.

## 7 Other Matters

### 7.1 DEEMED VALUES

Deemed values are an economic tool that incentivises commercial fishers not to catch in excess of their individual annual catch entitlements. A discussion of the deemed value rates for SCACS is included in the accompanying consultation document “Review of Deemed Value Rates for Selected Stocks”.

### 7.2 RECREATIONAL CONTROLS

There is no information to suggest a change to recreational controls would be needed and no changes to the recreational daily bag limit are proposed.

## 8 Conclusion

Available information suggests the biomass of SCACS has declined since the TAC and TACC were last increased in 2013.

Option 1 proposes no changes to current management settings. Option 2 proposes a reduction to the TAC and TACC. Option 1 provides for greater commercial harvest than Option 2. Both options take into account, to a greater and lesser extent respectively, the relatively high biomass estimates and landings in this fishery since 2004 and the operation of the CPUE-limit rule and other elements of the management framework.

MPI is seeking information and views from tangata whenua and stakeholders to support the development of final advice to the Minister on management settings for SCACS for the fishing year commencing 1 April 2016.

It is important to note that the Minister has broad discretion in exercising his powers of decision-making. He will make his own independent assessment of the information presented to him before making a final decision on varying a TAC, allowances and TACC.

## Appendix One – Biological Information

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*Pecten novaezelandiae* is one of several species of “fan shell” bivalve molluscs found in New Zealand waters. *P. novaezelandiae* is endemic to New Zealand, but is very closely related to the Australian species *P. fumatus* and *P. modestus*.

Scallops are found in a variety of coastal habitats, but particularly in semi-enclosed areas where circulating currents are thought to retain larvae. After the planktonic larval phase and a relatively mobile phase as very small juveniles, scallops are largely sessile but can move actively, mainly in response to predators. Scallops can also be moved considerable distances by currents and storms and are sometimes thrown up in large numbers on beaches.

Scallops become sexually mature at a size of about 70 mm shell length. They are extremely fecund and may spawn several times each year. The major settlement of spat in northern fisheries usually takes place in early January.

The very high fecundity of this species, and likely variability in the mortality of larvae and pre-recruits, leads to great variability in annual recruitment. This, combined with variable mortality and growth rate of adults, leads to scallop populations being variable, especially in areas of rapid growth where the fishery may be supported by only one or two year classes. This variability is characteristic of scallop populations world-wide, and often occurs independently of fishing pressure.

The growth of scallops within the Coromandel fishery is variable among areas, years, seasons and depths, and probably among substrates. In the Hauraki Gulf scallops have been estimated to grow to 100 mm shell length in 18 months or less, whereas this can take three or more years elsewhere. In some years, growth is very slow, whereas in others it is very rapid. Scallops in shallow water also tend to grow much faster than those in deeper water.

A variety of studies suggest that average natural mortality in the Coromandel fishery is quite high at  $M = 0.50 \text{ y}^{-1}$  (instantaneous rate), and maximum age in unexploited populations is thought to be about 6 or 7 years.