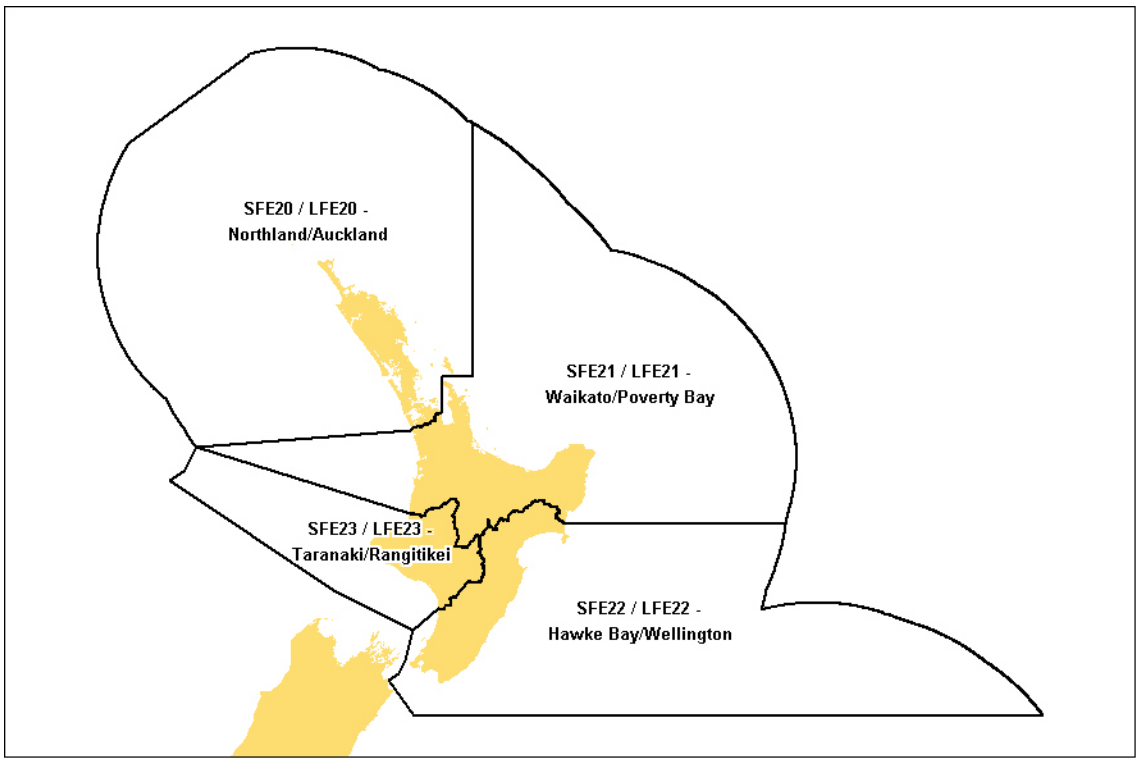
NORTH ISLAND EELS (SFE 20-23, LFE 20-23)

Figure 1: **Quota management areas for shortfin (SFE) and longfin (LFE) eel stocks in the North Island.**



Executive Summary

1 The North Island eel fishery consists of four shortfin (Anguilla australis / A. reinhardtii) and four longfin (A. dieffenbachii) stocks (Figure 1). The fishery was introduced into the quota management system (QMS) on 1 October 2004 with total allowable catches (TACs) set under section 14 of the Fisheries Act 1996 (the Act).

2 In setting TACs under s 14 of the Act, the previous Minister agreed to a management strategy to improve the stock structure (ie, size composition) and abundance of eels over the medium term (10 years), while bringing to a halt any decline in the fishery over the short term. The Minister's intention was to ensure that:

a) the fishery is sustainably managed;

b) the fishery's availability to non-commercial fishers is improved;

c) the relationship with interdependent stocks is improved.

3 The initial management settings applied to North Island eel stocks in 2004 were considered to be a reasonable starting point, although it was

acknowledged that further initiatives to improve the fishery would be required over the short to medium term. Having reviewed the available information on the status of the eight stocks, MFish is of the view that the present management strategy and its intended outcomes are not presently being met, and further refinement of these settings are required.

4 The TACs for all but one North Island eel stock have not been fully caught since introduction into the QMS. The present TACs for shortfin stocks are unlikely to rebuild the fishery, and are only likely to retain the fishery in a depleted state. MFish proposes to reduce TACs for shortfin stocks to either a mid-point between the existing TAC and recent catch, or to levels of recent catch.

5 MFish proposes to reduce TACs for longfin stocks to either levels at or about recent catch, or to levels that are about 20% below recent catch. The proposed TAC options are more conservative than shortfin stocks on the basis that current longfin catches are not sustainable.

6 If TACs are reduced, the Minister will need to consider the manner in which catch reductions are achieved for each stock. Eels are highly valued by Māori and contribute significantly to their social, cultural and economic well-being. In determining a total allowable commercial catch (TACC) for each stock, MFish has proposed that customary harvest be provided for in full when allowing for customary use. MFish has not proposed to alter the nominal allowances made for other sources of fishing related mortality.

7 MFish proposes that recreational allowances are either retained at their existing levels while TACCs are reduced (non-proportional approach), or recreational allowances and TACCs are reduced by the equivalent percentage amount (proportional approach).

8 In reaching a decision on the allocative approach, it is pertinent to note that eels are a highly valued non-commercial resource, with many communities depending on eel fishing for subsistence. In addition, the recreational allowance was set at a level below estimated harvest levels when North Island eel stocks were introduced in 2004. MFish believes that a non-proportional approach would be more consistent with the statutory obligations, and if acceptable to the current Minister, the management strategy determined for the North Island eel fishery.

9 The impacts of these allocative options on the commercial sector are not considered significant in the short term as the TACCs for most stocks are not fully caught. The impacts for the commercial sector are greater for longfin than shortfin. In the longer term, benefits to all sectors should include a better quality catch, and more efficient harvesting activities.

10 The current initiative is part of a longer term programme to significantly improve the status of eels. Introduction of the North Island eel fishery into the QMS in 2004 provided a better basis from which management decisions on sustainable use could be made. Further initiatives include the preparation of fisheries plans to better articulate the fisheries management objectives for the

fishery. It is not the purpose of this catch limit review to canvass these other initiatives. However, the present proposals are consistent with a general direction to further reduce sustainability risks to the fishery, while improving the use and values associated with the fishery.

Summary of Options

11 For all shortfin stocks, it is proposed to vary the TAC based on either:

a) *Shortfin option 1* – reducing the TAC to a mid-point between the existing TAC and recent catch (average catch derived from the 2004-05 and 2005-06 fishing years);

b) *Shortfin option 2* – reducing the TAC to a level at or near recent catch.

12 For all longfin stocks, it is proposed to vary the TAC based on either:

a) *Longfin option 1* – reducing the TAC to a level at or near recent catch;

b) *Longfin option 2* – reducing the TAC to a level about 20% less than recent catch.

13 For quota management area 20 (Northland/Auckland), the options for proposed TACs, allowances and TACCs are shown in Table 1.

Table 1: Options for proposed TACs, allowances and TACCs (in tonnes) for SFE 20 and LFE 20. 'Other' means the allowance for other sources of fishing related mortality.

Stock Option	Allocation	TAC	Recreational Allowance	Customary Allowance	Other	TACC
SFE 20 option 1	Proportional	179	23	30	4	122
	Non-proportional	179	28	30	4	117
SFE 20 option 2	Proportional	148	18	30	4	96
	Non-proportional	148	28	30	4	86
LFE 20 option 1	Proportional	45	5	10	2	28
	Non-proportional	45	8	10	2	25
LFE 20 option 2	Proportional	39	4	10	2	23
	Non-proportional	39	8	10	2	19

14 For quota management area 21 (Waikato/Poverty Bay), the options for proposed TACs, allowances and TACCs are shown in Table 2.

Table 2: Options for proposed TACs, allowances and TACCs (in tonnes) for SFE 21 and LFE 21. 'Other' means the allowance for other sources of fishing related mortality.

Stock Option	Allocation	TAC	Recreational Allowance	Customary Allowance	Other	TACC
SFE 21 option 1	Proportional	195	18	24	4	149
	Non-proportional	195	19	24	4	148
SFE 21 option 2	Proportional	181	16	24	4	137
	Non-proportional	181	19	24	4	134
LFE 21 option 1	Proportional	75	8	16	2	49
	Non-proportional	75	10	16	2	47
LFE 21 option 2	Proportional	60	6	16	2	36
	Non-proportional	60	10	16	2	32

15 For quota management area 22 (Hawke Bay/Wellington), the options for proposed TACs, allowances and TACCs are shown in Table 3.

Table 3: Options for proposed TACs, allowances and TACCs (in tonnes) for SFE 22 and LFE 22. 'Other' means the allowance for other sources of fishing related mortality.

Stock Option	Allocation	TAC	Recreational Allowance	Customary Allowance	Other	TACC
SFE 22 option 1	Proportional	128	10	14	2	102
	Non-proportional	128	11	14	2	101
SFE 22 option 2	Proportional	121	10	14	2	95
	Non-proportional	121	11	14	2	94
LFE 22 option 1	Proportional	41	4	6	2	29
	Non-proportional	41	5	6	2	28
LFE 22 option 2	Proportional	34	3	6	2	23
	Non-proportional	34	5	6	2	21

16 For quota management area 23 (Taranaki/Rangitikei), the options for proposed TACs, allowances and TACCs are shown in Table 4.

Table 4: Options for proposed TACs, allowances and TACCs (in tonnes) for SFE 23 and LFE 23. 'Other' means the allowance for other sources of fishing related mortality.

Stock Option	Allocation	TAC	Recreational Allowance	Customary Allowance	Other	TACC
SFE 23 option 1	Proportional	43	4	6	2	31
	Non-proportional	43	5	6	2	30
SFE 23 option 2	Proportional	36	4	6	2	24
	Non-proportional	36	5	6	2	23
LFE 23 option 1	Proportional	41	5	14	2	20
	Non-proportional	41	9	14	2	16
LFE 23 option 2	Proportional	34	4	14	2	14
	Non-proportional	34	9	14	2	9

Background

17 Freshwater eels have relatively unique life history characteristics in comparison to other fish species resident in New Zealand. They breed only once, migrating from the area where they have spent much of their life to an oceanic spawning ground in the South Pacific (or the Coral Sea for A. reinhardtii). Larvae then undertake a long oceanic migration, arriving as glass eels in estuarine and freshwater environments throughout the country between August and November.

18 Female longfins migrate to spawn typically at 49-56 years of age, although those found in productive habitats may migrate at less than 25 years of age. Female shortfins typically migrate to spawn between 9-41 years. Accordingly, eels are not a productive species and a conservative management strategy is warranted.

19 In addition, unlike any other exploited fish species, the freshwater eel fisheries around the world are based entirely on pre-spawning fish. This presents particularly difficulties in applying sustainability measures. Worldwide freshwater eel fisheries are in serious decline because of over exploitation and habitat loss. The New Zealand eel fisheries, although faced with similar challenges from exploitation, habitat loss, and the effects of hydro dams and other obstructions to fish passage, are possibly in better health than the comparable Japanese, European and American eel fisheries. Nevertheless New Zealand eel stocks remain vulnerable.

20 Eels are highly valued by Māori for subsistence and cultural practices. The non-commercial use of eels has decreased as their abundance and the proportion of medium to larger sized eels has declined, particularly since the 1960s. Eel fishing also forms a recreational activity in learning about the

natural world and outdoor self-sufficiency. New immigrants within the greater metropolitan area have taken an interest in the harvest of eels since at least the 1990s.

21 Commercial fishing of eels commenced in earnest in the 1960s, and peaked in 1975 at approximately 2434 tonnes for the country. Since at least the early to mid-1980s, the fishery was considered fully developed. Restrictions on commercial access were introduced from the early 1980s and were progressively strengthened over time. Commercial eel catch from the North Island has generally declined, particularly since the mid 1990s.

22 To address sustainability and utilisation concerns, the North Island eel fishery was introduced into the QMS in 2004. The previous Minister of Fisheries set TACs under s 14 of the Act on the basis that it was not possible to estimate maximum sustainable yield for the various North Island eel stocks.

23 In setting TACs under s 14 of the Act, there is an obligation to ensure that TACs better meet the purpose of the Act than if the TACs were set under s 13. In order to provide guidance on what principles might be used to better meet the purpose of the Act under s 14, a high level management strategy was adopted by the previous Minister. The strategy sought to improve the stock structure (ie, size composition) and abundance of eels over the medium term (10 years), while bringing to a halt any decline in the fishery over the short term. The intention is to ensure that:

a) the fishery is sustainably managed;

b) the fishery's availability to non-commercial fishers is improved;

c) the relationship with interdependent stocks is improved.

24 Table 5 sets out the previous Minister's decisions for catch limits and allowances as at 1 October 2004. In its advice to the Minister, MFish recommended these limits and allowances on the basis that they were "a reasonable starting point from which the management strategy can be addressed, while further review of commercial and non-commercial catch information and new scientific information can contribute to any necessary refinements in future years". Across the North Island the shortfin commercial catch was reduced by around 8.25%, and the longfin commercial catch was reduced by around 17.8%, in comparison with the average commercial catch taken in the 2000-01 and 2001-02 fishing years.

Table 5: TAC, allowances for non-commercial interests and other sources of fishing-related mortality, and TACC (in tonnes) for shortfin and longfin eel stocks in the North Island. 'Other' means the allowance for other sources of fishing related mortality.

Stock	TAC	Recreational allowance	Customary allowance	Other	TACC
SFE 20	211	28	30	4	149
LFE 20	67	8	10	2	47
SFE 21	210	19	24	4	163
LFE 21	92	10	16	2	64

SFE 22	135	11	14	2	108
LFE 22	54	5	6	2	41
SFE 23	50	5	6	2	37
LFE 23	66	9	14	2	41

25 Both shortfin and longfin species are distributed nationally and form one biological stock for each species. Strategically, management actions will need to take this into account. The initiatives taken since 2000 to introduce catch limits for eel stocks across the country were timely given sustainability concerns and other obligations. In the future, the current management arrangements are able to be refined to provide greater consistency in the approach to management of these resources.

Rationale for Management Options

Fishery Assessment

26 The 2007 MFish Fishery Assessment Working Group report for eels concluded that given the biology of eels, there is a high risk that the current exploitation levels for longfin in particular, coupled with past and present anthropogenic impacts, are not sustainable. Based on available information, the Working Group does not consider that the same risk applies to shortfin, although caution is required given the nature of eel biology and exploitation before spawning escapement. The Working Group recognises that there is insufficient information available to make specific recommendations on catch levels for either shortfin or longfin stocks.

Consideration of management strategy

27 TACs were set for North Island eel stocks under s 14 of the Act in 2004. The management strategy at the time was to "improve the stock structure (ie, size composition) and abundance of eels over the medium term (10 years), while bringing to a halt any decline in the fishery over the short term". While the Minister has the discretion to change this management strategy, MFish believes that the strategy remains appropriate and should be confirmed.

28 However, MFish is not confident that the management strategy outcomes for North Island eel stocks will be achieved within a 10 year timeframe at current TAC levels. The current longfin TACs are not sustainable for the longer term and the biomass of each stock could further decline over the medium term. The current shortfin TACs are not likely to provide for a rebuild of those stocks, in terms of average shortfin size and relative abundance of shortfin populations. Sustainability and utilisation outcomes are more likely to be achieved if a more cautious approach to the setting of TACs is adopted. Similarly, the functioning of ecosystems and interrelationships with other stocks is likely to better reflect natural processes where there is a more representative range of eel size classes in a population.

29 The development of fisheries plans over the next few years will provide opportunities to discuss more specific management objectives for the eel fishery, and how they might be achieved. However, MFish does not wish to

defer management action for North Island eel stocks that would be in keeping with the purpose and principles of the Act.

Monitoring commercial fishery information

30 MFish commission's research to collate the size and species composition of commercial eel catches. Recent research has characterised the commercial catch in the fishing years 2003-04 through to 2005-06. The research programme has captured about 90% of the North Island landed catch in the 2003-04 and 2004-05 fishing years, and virtually all the landed catch in the 2005-06 fishing year. The research programme continues in the current 2006-07 fishing year.

Size grade information

31 Despite reduced levels of commercial catch in fishing years preceding the application of catch limits from October 2004, there is no clear trend to show that the average size of eels in either shortfin or longfin stocks has increased. An increase in the proportion of large eels in the North Island commercial catch would indicate an improvement in shortfin and longfin population size structure.

32 Sampling of commercial catch at eel processing factories in the mid-1990s showed that there were no large longfin females and only small numbers of large shortfin females being taken from major commercial fisheries in mainstem rivers and lakes. This finding was disputed by some industry members. The development of more intensive sampling of commercial catch from a wider range of areas was subsequently implemented.

33 For the two main North Island processors the proportion of eels (by weight) landed in each size grade for each species has been reasonably consistent over the 2003-04 to 2005-06 period. Throughout this time period, the proportion of large longfin eels (greater than either 1 kg or 1.2 kg) ranged from 30 to 38% for all landings. The proportion of large shortfin eels (greater than 1 kg) ranged from 9 to 17%. The current size frequency distributions for shortfin and longfin stocks are significantly different to that observed by eel processors in the 1970s when large eels were more commonly taken.

34 Typically longfin males migrate at a size of approximately 65 cm or 750 g, whereas longfin females are usually nearing 90 cm and are 2 kg in weight. Shortfin males migrate at a size of approximately 40 cm or ~200 g, whereas shortfin females migrate at a size of approximately 80 cm or 1.25 kg. Consequently, almost all of the large eels greater than 1 kg in weight are very likely to be females. The reduced proportion of shortfin females observed over 1 kg in weight may reflect the possibility that a portion of the population has naturally migrated rather than been fished. However, this is less likely an explanation for longfin females.

35 Quantitative size grade information is not available at size grades larger than 1.2 kg for North Island eel stocks. This would be more informative in terms of assessing the proportion of the stock that is taken by the commercial fishery at these larger sizes. However, one factory advised in 2006 that its annual processing of eels greater than 4 kg was about 2%. This observation re-enforces concerns held for longfin stocks in particular because a higher proportion would be expected, even in a modestly fished stock. This

observation also supports the view that areas intensively fished over a long time are less likely to hold a significant number of large female longfins.

36 The size grade information does not necessarily show signs of any further deterioration in size frequency distributions of commercially landed catch for either shortfin or longfin. However, MFish considers that the current size frequency distributions for both shortfin and longfin stocks require significant improvement. There is a need to improve average size of shortfin and longfin populations for both utilisation and sustainability outcomes. These outcomes extend to the importance of large eels in ecological processes and the effectiveness of non-commercial or commercial fishing activities.

Species composition

37 The proportion (by weight) of shortfin to longfin in the North Island commercial catch has not improved over the last few fishing years. An increase in the proportion of longfin in commercial catch would indicate that longfin stocks were rebuilding.

38 Across the North Island in the 2003-04 through to the 2005-06 fishing years, shortfin accounted for almost three-quarters of the commercial catch. Much of this catch was derived from Northland and the Waikato. The small proportion of the overall North Island commercial eel catch taken in quota management area 23 (Taranaki/Rangitikei) was dominated by longfin in these fishing years. Trends in the proportion of shortfin to longfin have not been overly affected by catch limits introduced in 2004 and the proportion of longfin in commercial landings continues to decline.

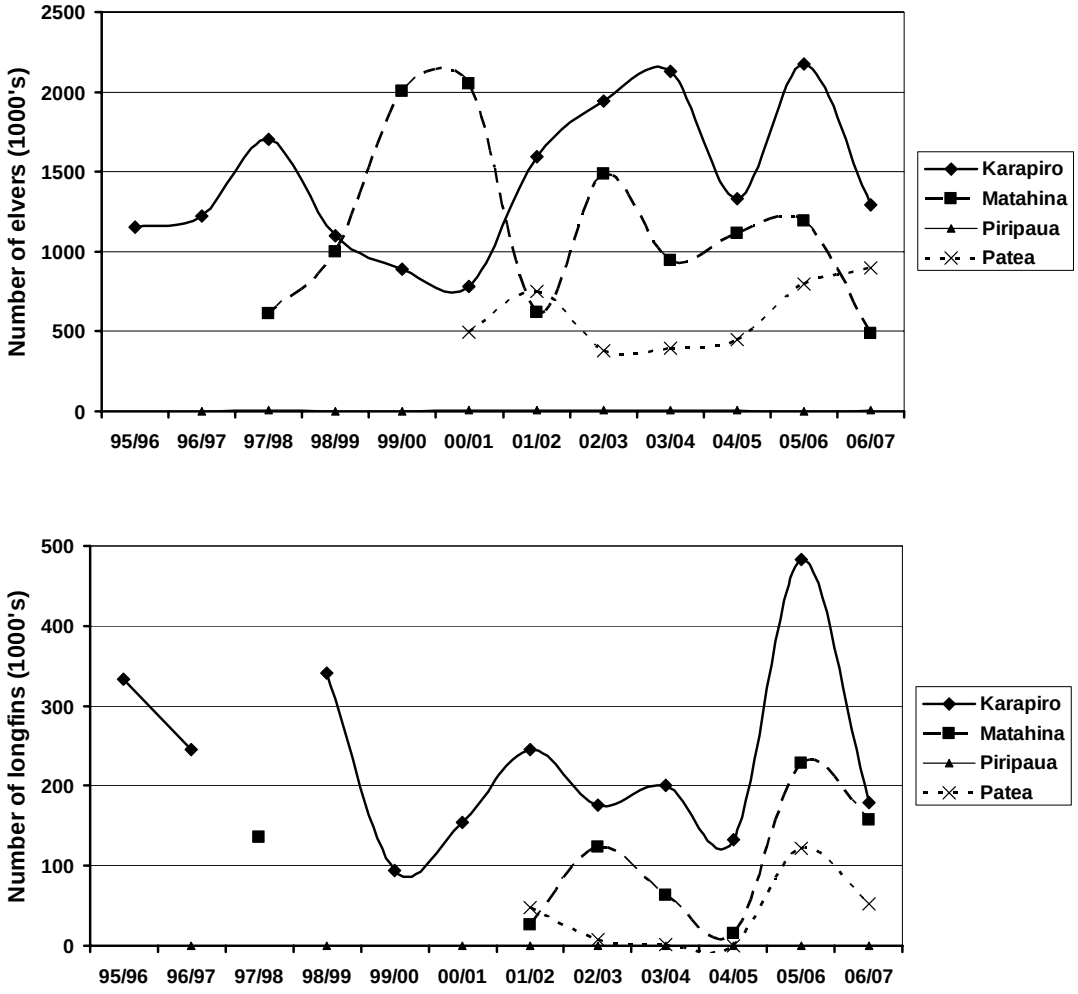
39 The proportion of longfin taken in the North Island during the period when the commercial fishery was considered past its development phase (mid 1970s through to late 1980s) was 10 to 20% greater than that experienced since 2001-02. In the earlier period of the fishery's development, longfin was a significant component of the North Island commercial catch. This supports the view that there has been an on-going gradual decline in longfin biomass, particularly in northern North Island stocks.

Recruitment indicators

40 MFish commissions research to monitor upstream elver and juvenile eel passage at hydro-electric power station dams and other locations. Data has been collected since the early 1990s. The monitoring includes collecting information on the quantity and species composition of elvers and juvenile eels.

41 Figure 2 shows the total number of elvers, and the number of longfin elvers, caught at four main sites within the North Island. Overall elver numbers vary at three of the four sites, but in general seem to be relatively stable, although the time series is relatively short. Few elvers were observed at Piripaua (Lake Waikaremoana). Longfin elver numbers appear to be in decline, although a large catch was made in the 2005-06 season, before returning to previously observed low levels in 2006-07.

Figure 2: Number of elvers, and number of longfin elvers, taken at various collection points in the North Island between 1995-96 and 2006-07.



42 The percentage composition of longfins in overall elver numbers migrating upstream on a historical basis is not known. However, the dominance of longfin in the adult population prior to the 1970s might suggest that the proportion of longfins in overall elver numbers may have been higher than more recently observed. More recently, the proportion of longfin elvers recorded as a percentage of the total catch at Karapiro Dam has reduced from around 25-30% over the period 1995-96 to 1998-99, to around 9-10% from 2002-03 to 2004-05. In 2005-06, the percentage of longfins increased to 22% of the total elver catch, but declined to nearer 15% in 2006-07.

43 The number of elvers arriving at Patea Dam in recent times is relatively low. Should current trends of recruitment continue, the number of longfin elvers arriving at Patea Dam may not be sufficient to maintain longfin populations into the upper catchment above the dam over the longer term. However, there is insufficient information about the relationship between juvenile eel density and survival of recruits to assess population risks.

44 The short time series makes it difficult to draw conclusions about the levels of recruitment observed, and its adequacy in terms of use and sustainability

outcomes. However, MFish's Fishery Assessment Working Group for eels has observed that the number of elvers undertaking their upstream migration is on a significantly smaller scale than observed historically (eg, early 1970s). This conclusion is consistent with previous observations, and suggests that the number of glass eels reaching New Zealand coastal waters has significantly reduced in comparison to observations made in previous decades. Increasing the number of migrating adult eels should improve the quantity of glass eels arriving in New Zealand.

Spawning escapement

45 As eel species breed only once at the end of their life, it is important to ensure that a sufficient number of eels reach a size (and age) where they will be able to undergo their migration to breeding grounds in the southwest Pacific Ocean. This is particularly important for female longfin eels which take, on average, some decades to reach the large size typically observed at migration.

46 The adequacy of reserve areas closed to commercial fishing for the survival and escapement of female longfin eels was the objective of a recently completed research project for MFish. The project did not extend to shortfin eels.

47 The initial assessment found that waters open to commercial fishing in the North Island may support an annual estimated commercial harvest rate for longfin of 8.6% of the total biomass in the period 1990-2002. The estimated commercial harvest rate reduced to 4.7% if all reserves and fished areas within the North Island are included. These estimates of annual harvest rate do not include exploitation from the non-commercial sector. Further, the estimated harvest rates for commercial eel fishing have reduced as a result of the catch limits applied at the time of introducing North Island eel stocks into the QMS. The actual harvest rate is lower still as the TACCs for North Island longfin (and shortfin) stocks have not been fully utilised since 2004-05.

48 Several assumptions used in the methodology to derive estimates of biomass and harvest rates require further investigation. As such, estimates of current biomass and harvest rate cannot be used to definitively inform proposals for longfin TAC reductions.

49 Modelling studies suggest annual harvest rates of longfin biomass at or above 5% are considered too high given the low productivity of the species. Harvest rates at this level would significantly affect the number of female longfins reaching sexual maturity and undertaking migration.

50 Both computer models and field studies indicate that relatively few large female longfin eels (above 700 mm) are presently left in fished areas and female spawning escapement is derived from mainly (80%) reserves and unfished small streams. The maximum size limit now applying throughout the whole country (1 April 2007) will have increasing relevance to protecting a portion of the female spawning biomass as the fishery rebuilds.

51 Current spawning escapement is probably less than 20% of levels that existed prior to the start of hydro dam construction and commercial eel fishing. Research assessments indicate the number of areas where commercial fishing is prohibited is not enough to ensure adequate longfin spawning escapement for the longer term rebuild of that species (at existing harvest levels).

52 Spawning escapement needs for shortfin are not likely to be as pressing as those for longfin. Female shortfin mature at an earlier size and age, and populations of shortfin in other countries are thought to contribute to recruitment in New Zealand. Nevertheless, given the likelihood that shortfin have been heavily fished for several decades prior to being introduced into the QMS, some caution is warranted.

Modelling information

53 There have been initial attempts in recent years to apply modelling techniques to eel populations in New Zealand. Simulations of Hoyle & Jellyman (2002) using annual harvest rates of 5% and 10% resulted in the spawning per recruit of female longfin populations being reduced by 83% and 96.5%, respectively, at the current minimum legal weight of 220 grams, and the maximum legal weight of 4 kg for the South Island. The 83% figure increased to 94.7% (ie, at a 5% harvest rate) if large female longfins were more easily caught in comparison to smaller less dominant female longfins. These figures have not been recalculated to take account of the extension of the maximum size limit to all New Zealand fisheries waters from April 2007.

54 The observations of relatively small quantities of elvers undertaking upstream migration at various sites around New Zealand would tend to confirm that spawning escapement of eel stocks have been significantly reduced. Similarly, fishing activities, at previous harvest rates, have removed a significant number of large eels.

55 Through the same exercise, models predicted a 48% reduction in spawning per recruit of female shortfins if harvest rates were at 10%, when compared to unfished populations. However, at this time no harvest rate estimates are available for shortfins. As elver numbers are lower than observed historically, the harvest rates for shortfin may also have been higher than desired.

56 In summary, the results of modelling studies across the country show reasonably consistent trends. If spawning escapement is to be improved over a broader area, then lower harvest rates will be necessary. This will provide more certainty that fishing activities, particularly for longfin, are sustainable over the longer term.

Use of the eel fishery

Non-commercial use

57 Non-commercial interests comprise both fishing for recreational (subsistence) and customary purposes. Children and other people from rural communities will typically undertake eel fishing as a pastime, as well as learning about the outdoors. Many New Zealanders also take eels for food, particularly in the

north of the North Island. Some people feed wild eels and raise them as if they were pets. Māori use extends from the customary purposes of hui and tangi, through to food gathering for subsistence purposes as managed in the North Island under recreational fishing regulations.

58 Māori representatives have stated that their people wish to see a significant improvement in the state of the resource in terms of average size and abundance, as the Minister agreed to in 2004. Some whānau and hapu have adopted rāhui to conserve remaining eel populations in specific waterways. Similarly, harvesting activities may now be limited to special occasions such as hui or tangi.

59 There are significant obligations to Māori for customary non-commercial fishing under generic provisions of the Act, and individual Deeds of Settlement. Those obligations are unlikely to be met if the current management settings do not improve the eel fishery beyond maintenance in a depleted state over the medium term.

60 MFish continues to seek information from tangata whenua about the nature and extent of their use of the eel fishery. Obtaining such information will better inform the management settings for the eel fishery.

61 The Fisheries (Kaimoana Customary Fishing) Regulations 1998 do not extend to aquatic life taken in freshwater at present, in contrast to the Fisheries (South Island Customary Fishing) Regulations 1998. Accordingly, information on the customary authorisations issued, and the quantity of eels taken for customary purposes is not available at this time. Tangata whenua are not required to submit information on the use of regulation 27/27A authorisations under the Fisheries (Amateur Fishing) Regulations 1986. Provision of such information would be helpful to both kaitiaki and MFish.

62 MFish has commissioned further research to better estimate the amount of eels taken for customary and recreational fishing purposes. Information from this research is not due to be reported to MFish in the timeframe for this review. On-going investigations of this nature will continue to inform stakeholders and MFish about the non-commercial use of eel stocks at the stock level.

Commercial use

63 The longer term trends in commercial use of the North Island eel fishery are shown in Figure 3. The reduction in commercial catch in the 2004-05 fishing year partly reflects the introduction of the fishery into the QMS on 1 October 2004. Other factors affecting the quantity of commercial catch include the number of fishers and processors, market price conditions, habitat modifications and droughts. There has been a declining trend in catch taken over the longer term.

64 Commercial catches since 1 October 2004 have not reached the TACCs set for each stock other than SFE 22 in the 2005-06 fishing year (Table 6). The extent of commercial shortfin under-catch over the 2004-05 and 2005-06 fishing years averages 28% across the North Island, and varies from 1% to

almost 60%. The extent of commercial longfin under-catch over the 2004-05 and 2005-06 fishing years averages 36% across the North Island, and varies from 16% to almost 50%. The trend of commercial under-catch is likely to be repeated for the current 2006-07 fishing year.

65 About half of the North Island commercial catch in the 2003-04 and 2004-05 fishing years were taken in the Northland and Waikato Eel Statistical Areas. These Eel Statistical Areas have always been the main areas where commercial fishing has been undertaken.

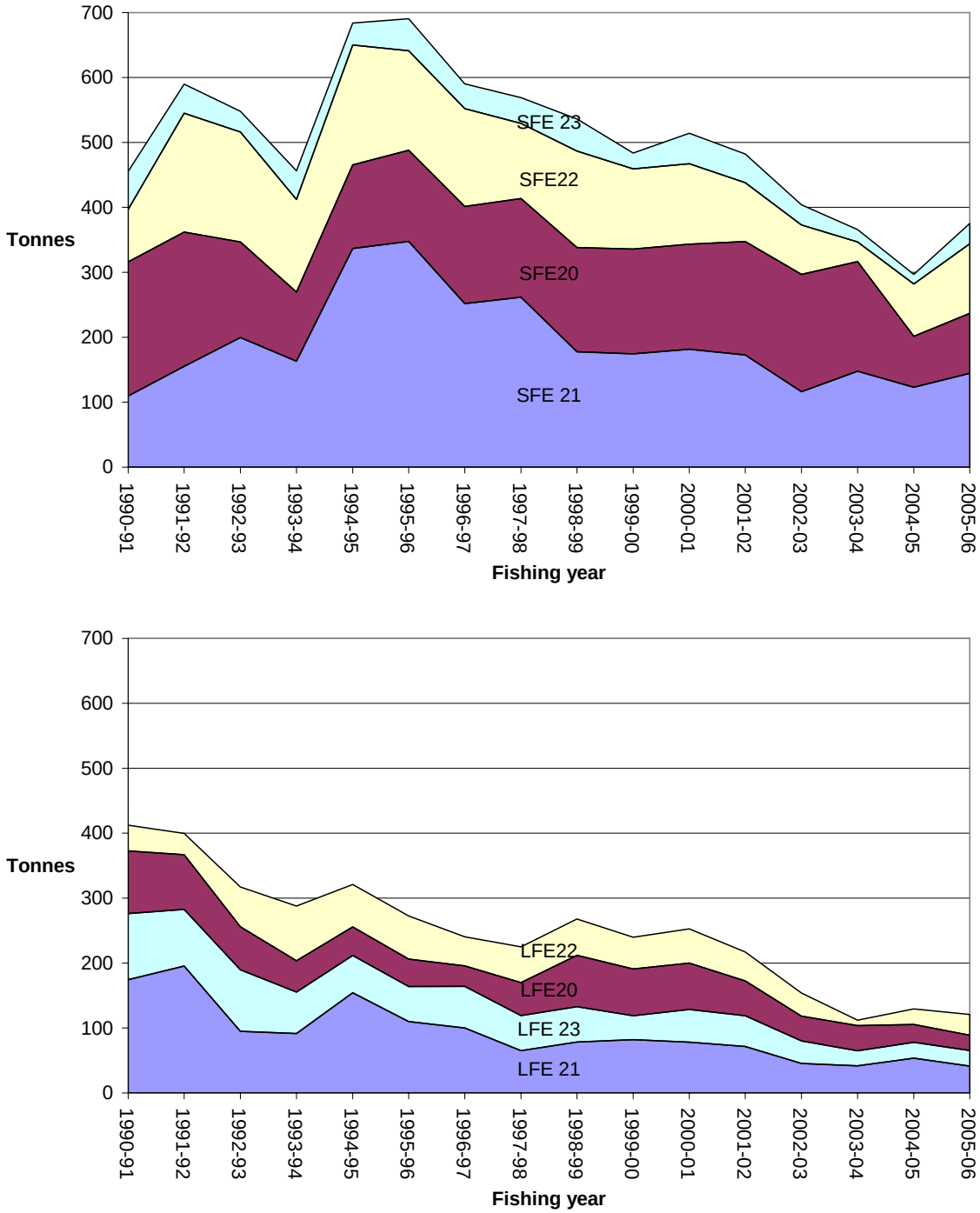


Figure 3: **Estimated commercial catch (in tonnes) of eel stocks of the North Island between 1990-91 to 2005-06 by quota management area. Top graph = shortfin eel stocks; bottom graph = longfin eel stocks.**

Table 6: Commercial catch (in tonnes) of North Island shortfin and longfin eel stocks since the 2004-05 fishing year. Sourced from a Monthly Harvest Return data extract of 28 May 2007. Percentage of TACC remaining uncaught is shown in brackets.

Stock	TACC	2004-05	2005-06	2006-07 (to 30 April)
SFE 20	149	78.41 (47.4)	93.25 (37.4)	68.39 (54.1)
LFE 20	47	27.42 (41.7)	23.74 (49.5)	16.36 (65.2)
SFE 21	163	122.95 (24.6)	144.33 (11.5)	71.85 (55.9)
LFE 21	64	53.52 (16.4)	41.18 (35.7)	22.24 (65.2)
SFE 22	108	80.53 (25.4)	106.90 (1.02)	72.99 (32.4)
LFE 22	41	23.86 (41.8)	31.64 (22.8)	23.19 (43.5)
SFE 23	37	14.95 (59.6)	31.46 (15.0)	28.85 (22.0)
LFE 23	41	24.52 (40.2)	24.19 (41.0)	12.46 (69.6)

66 Commercial catch in the 2004-05 fishing year is likely to have been affected by industry rationalisation following QMS introduction. However, a number of commercial eel fishers have retained their interest in the fishery, either as quota holders or as annual catch entitlement (ACE) holders (Table 7). There has been no shortage of people entering the fishery as ACE holders (although many do not last more than a few months), and there is no information to suggest that ACE is being withheld from general use in each stock.

Table 7: Number of North Island eel stock quota share owners at 1 October 2004 and 2 May 2007, and number of annual catch entitlement (ACE) holders as at 2 May 2007.

Eel Stock	Number of quota share owners as at 1 October 2004	Number of quota share owners as at 2 May 2007	Number of holders of annual catch entitlements (ACE) as at 2 May 2007
SFE 20	33	17	57
LFE 20	33	17	53
SFE 21	28	13	26
LFE 21	28	13	29
SFE 22	18	16	26
LFE 22	18	15	26
SFE 23	19	9	17
LFE 23	17	8	18

Summary of rationale for catch limit review

67 MFish does not believe that retaining the existing TAC for each North Island eel stock will achieve the purpose of the Act. The best available information suggests the existing longfin catch levels are not sustainable in the longer term. The status of shortfin is less well known from a scientific perspective, but size composition data, the level of use, and perceptions of the condition of the fishery all suggest that the management strategy is unlikely to be achieved within the 10 year timeframe under the existing TACs (and other management settings).

68 Deferring a review of catch limits may unnecessarily place the longfin stocks at further sustainability risk, and potentially increase pressure on shortfin stocks. Significant improvements in average eel size, species composition and relative abundance are not evident at existing TACs. A review of catch limits at this time will provide more assurance that the fishery is not placed at further risk while discussions about the management outcomes for the fishery are further refined.

Assessment of Management Options

Adjusting the Total Allowable Catch

69 This section discusses the relative merits and risks of each management option for each of the North Island eel stocks.

Proposed TAC options

70 In the options that follow, 'recent catch' for each North Island eel stock is assessed as the summation of allowances for non-commercial fishing activity, other sources of fishing related mortality, and the average commercial catch derived from the 2004-05 and 2005-06 fishing years. MFish does not have substantive information available to document the quantity of shortfin or longfin eels used at the level of each stock for non-commercial fishing purposes, or the quantity of eels that may be allowed for as other sources of fishing related mortality. MFish has assumed that the allowances made for non-commercial fishing purposes and other sources of fishing related mortality have been fully used for the purpose of calculating the proposed TACs in this paper.

71 The commercial catch for each North Island eel stock in the incomplete 2006-07 fishing year are relatively similar to that experienced in the 2005-06 year. Accordingly, calculating the average commercial catch on the preceding two fishing years is not considered unrepresentative of commercial catch in the current fishing year (ie, 2006-07).

Shortfin stocks

72 Two general approaches for the calculation of revised TACs for North Island shortfin stocks have been considered. Each approach should better achieve the purpose of the Act than observed under the existing TACs. Each option recognises that shortfin stocks have not shown any significant improvement in their size composition for several years, and that some TAC adjustment is

justified to improve the likelihood that the purpose of the Act can be better achieved. As commercial catch-per-unit-effort (CPUE) indices for three of the four North Island shortfin stocks were not in decline between 1990 and 2002, MFish does not consider it necessary at this time to propose an approach where existing TACs are reduced significantly below levels of recent catch.

73 The two approaches for shortfin stocks are:

a) *Shortfin option 1*: reducing the TAC to a mid-point between the existing TAC and recent catch;

b) *Shortfin option 2*: reducing the TAC to a level at or near recent catch.

74 Under shortfin option 1, the proposed TACs are below the likely harvest levels from all sectors experienced since 1990. There is likely to be an improvement in the status of shortfin stocks over the rebuild timeframe of 10 years. If new information is received indicating little or no improvements, then a further review can be undertaken.

75 Shortfin option 2 provides more certainty that an improvement in the fishery will be achieved within the 10 year management strategy timeframe. Improvements in shortfin population structure have not been evident over the last few years, even though catch has been lower than that experienced over recent decades. There should be a greater chance that shortfin population structures would improve under this option, leading to an increase in average size and availability. Any improvements in the status of the stock would not be automatically lost through increased catch under a higher TAC.

Longfin stocks

76 Two general approaches for the calculation of revised TACs for North Island longfin stocks have been considered. The approach for longfin is more conservative than shortfin on the basis that there is a high risk that existing TACs are not sustainable. Other than the information already outlined, it is also of note that CPUE indices for commercial fishing activities were declining for all North Island longfin stocks over the period 1990-2002. Further updates on these indices will not be available until early 2009.

77 The approaches for longfin stocks are:

a) *Longfin option 1*: reducing the TAC to a level at or near recent catch;

b) *Longfin option 2*: reducing the TAC to a level about 20% less than recent catch.

78 Longfin option 1 recognises that the actual harvest rates for North Island longfin stocks experienced since 2004-05 have reduced. Adoption of this option would not necessarily address sustainability risks in the longer term. Nevertheless, it is more likely to represent an improvement over the existing TACs by reducing risk in the short term. Similarly, improvements in stock

structure and availability of suitably sized eels may become apparent over the medium term.

79 Future adjustments in catch limits, and/or the implementation of other management measures, may be needed within the next few years should longfin option 1 be adopted. Using this approach, stakeholders will have an opportunity to further consider future management measures suitable for longfin stocks, while minimising short term impacts on the fishery.

80 Adoption of longfin option 2 recognises that the current longfin catch is not able to be sustained for the longer term. The purpose of the Act would be better met if a reasonable reduction in TAC was made sooner rather than later. Adopting TACs under longfin option 2 recognises that reasonably significant reductions in catch limit are likely to be required to address both sustainability and utilisation concerns, and progress needs to be made beyond the 'starting point' TACs set in 2004.

81 TACs envisaged under longfin option 2 are more likely to better meet the purpose of the Act than either the present TAC or a TAC proposed under longfin option 1. Adoption of this option recognises that current spawning biomass levels have been significantly reduced under previous harvest rates. This is evident from recent observations of relatively low recruitment, and observations of reduced numbers of large eels within commercially fished populations.

82 Longfin options 1 and 2 are justifiable on the available information. However, the Minister may consider a more cautious approach is required if he is satisfied that such an approach would better meet the purpose of the Act. This could be applied in one or more longfin stocks, depending on the need. Some longfin stocks may need more rebuilding than others. Alternatively, the Minister may direct that a further review of catch limits is undertaken when further information and outcomes from other management initiatives are available.

Application of TAC options to each stock by quota management area

83 All TAC options are shown in Tables 1-4, in the 'Summary of Options' section. This section notes specific information relevant to each of the eight North Island eel stocks.

SFE 20 – Northland/Auckland

84 About 50-60% of the 2003-04 and 2004-05 commercial catch of shortfin in Northland and Auckland consists of fish of less than 500 grams in weight. The fishery in most parts of the stock has been subject to intensive fishing for many years. The eel fisheries of the upper North Island are in most need of rebuilding in terms of size structure of sampled populations.

85 Under shortfin option 1, the TAC would be reduced from 211 tonnes to 179 tonnes. The productivity of this northern stock is likely to be better than shortfin stocks in more southern latitudes, and improvements in size structure are more likely to become apparent in a shorter timeframe. Accordingly, adoption of a TAC of 179 tonnes would acknowledge that the stock could still respond favourably, and the level of potential risk to sustainability and use outcomes is acceptable over the short term. The performance of the stock would continue to be monitored and future adjustments to management settings could be made under the current management strategy.

86 The opportunity could be taken to reduce the TAC from 211 tonnes to 148 tonnes under shortfin option 2. This is a more cautious approach, and would recognise that there is insufficient information to gauge whether catch at this

or higher levels would be sustainable. There would be increased certainty that improvements in the fishery would materialise within the 10 year rebuild timeframe, even if no other management settings were adjusted.

LFE 20 – Northland/Auckland

87 MFish believes that northern longfin stocks (LFE 20 and LFE 21) require more attention than southern longfin stocks (LFE 22 and LFE 23) in terms of meeting the objectives of the management strategy. The size structure of longfin populations in commercial landings and the reduced proportion of longfin in commercial eel catch from the Northland/Auckland quota management area, suggest that significant improvements in the fishery could be made. Preliminary estimates of harvest rate under the current TAC are relatively high for the LFE 21 stock at 7.7%.

88 Under longfin option 1, the TAC would reduce from 67 tonnes to 45 tonnes. This option could be chosen if stakeholders wish to await the outcome of further research on the status of the stock, and/or the outcome of further fisheries management discussions. Adoption of this option is feasible for the short term. Monitoring activities should be able to discern any noticeable changes in this northern stock should the Minister choose this option.

89 Reducing the TAC for LFE 20 from 67 tonnes to 39 tonnes under longfin option 2 would reduce the harvesting rate to a lower level, and better achieve sustainability outcomes. Longfin populations in LFE 20 may be more productive than other longfin stocks in more southern latitudes. Adopting more conservative strategies in the LFE 20 stock may be beneficial to other longfin stocks.

SFE 21 – Waikato/Poverty Bay

90 The SFE 21 stock covers a broad and varied geographic area. Much of the area has been significant to commercial fishing operations over recent decades, particularly the Waikato-King Country area and the Hauraki Plains. Recent sampling of commercial catch confirms that shortfins (78%) dominate the overall eel catch from the quota management area. The composition of the catch, by species, has changed since the 1970s, as significant fishing pressure has depleted longfin populations, and shortfin populations in some areas have become subject to similar fishing pressure. Across the North Island, the highest proportion of small (<500 g) shortfins were found in parts of the Waikato catchment.

91 Reducing the TAC from 210 tonnes to 181 tonnes under shortfin option 1 recognises that the stock should not be exposed to harvest levels that might not achieve the management strategy. The fishery is likely to be maintained at the proposed TAC, having noted that the CPUE index has been stable between 1990 and 2002 when commercial catch was higher. Adopting shortfin option 1 would also recognise that more significant reductions to the TAC need not occur at this time, and that a further assessment of management options can be considered over the next few years. However, it is not known whether adoption of a TAC under shortfin option 1 would lead to any significant improvement in stock characteristics.

92 Reducing the TAC from 210 tonnes to 148 tonnes under shortfin option 2 recognises that several key areas of the stock require improvements consistent with the intention of the management strategy. This stock produced the lowest proportion of large shortfin in comparison to other North Island shortfin stocks.

93 The current harvest rate for the stock is not known, and there are no reference biomass estimates, so some further caution would be exercised if shortfin option 2 was adopted. While the CPUE index for this stock may be relatively stable during the period 1990-2002, biomass levels may also be unnecessarily low in terms of fishery performance. Similarly, the quantity of catch may be able to be maintained, but the quality and condition of the catch may not improve more generally.

LFE 21 – Waikato/Poverty Bay

94 Preliminary estimates of harvest rate under the current TAC are relatively high for the LFE 21 stock at 4.4%. The LFE 21 stock requires some significant rebuilding following the extensive commercial use of the stock in recent decades. The size structure of commercial landings, and the proportion of longfin in commercial eel catch from the Waikato/Poverty Bay quota management area, could be significantly improved. The CPUE index for commercial fishing in this stock declined between 1990 and 2002.

95 Adoption of longfin option 1 would reduce the TAC to 75 tonnes. While acknowledging the uncertainty around the estimated harvest rates, the effect of reducing the TAC to 75 tonnes would theoretically reduce the estimated harvest rate to 3.6%. More generally, adoption of this proposed TAC might be appropriate if it was felt that further consideration of management measures in the near future would derive significant positive outcomes for the stock. Similarly, further research may provide more certainty to estimated biomass levels and harvest rates. Monitoring of commercial catch characteristics would indicate whether any improvements are apparent over the next few years, and further action could be taken if insufficient progress was being made.

96 Under longfin option 2, a reduction in the TAC from 92 tonnes to 60 tonnes would provide a more cautious approach than option 1. Reducing the TAC below levels of recent catch would be more realistic in terms of the likelihood of achieving improvements in the stock over the medium term. Reducing catch below recent levels would further contribute to the rebuilding of the stock, and therefore better meet the purpose of the Act. The estimated harvest rate would reduce to 2.9% of current biomass.

SFE 22 – Hawke Bay/Wellington

97 The shortfin fishery in the SFE 22 stock has been well utilised over the decades, and there is evidence of a long term decline in the average size of eels processed at one of the main eel processing factories. Some commercial fishers have commented that much of the main stem rivers in the east coast region of the stock have been heavily fished, and much of the commercial catch is derived from farm properties where general access is not available.

98 The SFE 22 shortfin stock was the only North Island shortfin stock to show a decline in its CPUE index for the period 1990 through to 2002. However, there were some discrepancies in the commercial catch figures that cast some uncertainty on the level at which the TAC should be set in 2004. At the level of the TACC, the amount of commercial catch available to be caught from 2004 did not significantly change from reported catch in previous years. An update on the CPUE index through to the end of the 2006-07 fishing year will be available in early 2009.

99 Anecdotal comments from a range of stakeholders suggest that the relative abundance and size structure of the shortfin resource has not shown any significant improvement since 2004, despite the level of commercial undercatch being minimal. A further reduction is warranted to better achieve the intentions of the management strategy; it is only a matter of degree.

100 Reducing the TAC from 135 tonnes to 128 tonnes using shortfin option 1 may not necessarily alter the status of the stock in a significant way over the short to medium term. Nevertheless, the reduction would be greater than achieved in 2004, based on reported catch. Further evaluation of research information over the next few years would give more confidence about the status of the stock.

101 Reducing the TAC from 135 tonnes to 121 tonnes under shortfin option 2 is more likely to alter the stock characteristics in a more positive way over the short to medium term. The longer term trends in the stock, as assessed through monitoring of commercial catch, and other anecdotes from stakeholders, are sufficient to justify adoption of a TAC under this option.

LFE 22 – Hawke Bay/Wellington

102 The average size of longfin from the LFE 22 stock over the longer term has declined from observations made of commercial landings to one factory. There is a concern that relatively more longfins are being harvested to maintain the same overall tonnages over the last two decades. However, recent commercial catch sampling suggests that the proportion of large longfin in LFE 22 were higher than northern longfin stocks. Despite this, anecdotes suggest that many larger longfin are now confined to the upper parts of catchments, or areas with limited access, particularly in the eastern part of the stock. In addition, growth rates in southern latitudes are typically longer as eels become less active in cooler water temperatures. Harvest rates should be lower for stocks with lower overall productivity.

103 Using longfin option 1, the TAC would be reduced from 54 tonnes to 41 tonnes. This is likely to reduce the estimated harvest rate from 3.3% to 2.5% of total current biomass. Adoption of a TAC at this level from the forthcoming fishing year may not significantly contribute to an improvement in the status of the stock over the medium term, as desired. Reducing the TAC from 54 tonnes to 34 tonnes under longfin option 2 is more likely to contribute to that goal. The estimated harvest rate for such a TAC is 2.1% of total current biomass.

SFE 23 – Taranaki/Rangitikei

104 Unlike other quota management areas, shortfins are not the dominant species taken by commercial fishers from this stock. The population size structure for this stock is generally better than other shortfin stocks in the North Island. However, the proportion of larger sized eels in sampled populations suggests that the fishery has been significantly modified from historic levels.

105 Reducing the TAC from 50 tonnes to 43 tonnes using shortfin option 1 should further contribute to maintaining population size structure and abundance of shortfins. Further monitoring of commercial catch and other information can establish whether the management strategy is likely to be achieved in the medium term under this TAC. Further actions can be proposed if no significant improvements are observed within the next few years.

106 Reducing the TAC from 50 tonnes to 36 tonnes using shortfin option 2 is likely to improve the probability that the objectives sought of the management strategy will be achieved.

LFE 23 – Taranaki/Rangitikei

107 The Taranaki/Rangitikei stock area is recognised as an area where longfin are still a significant component of the eel fishery. The TAC introduced in 2004 was set at a level recognising the importance of maintaining longfin populations in this stock. In general, commercial landings from LFE 23 (and LFE 22) have relatively high proportions of large eels in comparison to northern longfin stocks.

108 Adoption of a TAC calculated using either longfin option 1 or longfin option 2 would further support the contribution that this stock is likely to make to spawning escapement, given the predominance of longfins in the quota management area.

109 Based on the characteristics of the stock observed through commercial catch sampling, it may be possible to maintain a reasonable population size structure under longfin option 1. Under this scenario, the TAC would be reduced from 66 tonnes to 49 tonnes. The estimated harvest rate would be 3.1% using this approach.

110 A more cautious approach would be to adopt a TAC calculated using longfin option 2. This would see the TAC reduced from 66 tonnes to 34 tonnes. The estimated harvest rate using this approach is 2.9% of current biomass. Adoption of this approach recognises that the longer term trends in size composition for longfin stocks across the North Island have been in general decline, and adjusting TACs for all longfin stocks can contribute to an overall improvement in the status of the species.

Total Allowable Commercial Catch and allowances

General observations

111 The Minister is required to make separate decisions on allowances for each stock when varying any TACC. Information about the recent catch in each stock can be used as a guide when considering decisions on allocation. However there are a number of factors relevant to the eel fishery that require special consideration in reaching a position on allowances for non-commercial fishing interests in that stock and all other mortality to that stock caused by fishing.

Customary Māori fishing purposes

112 Eels are taonga, and the eel fishery is of particular significance to Māori. Māori have historically used the resource for a range of purposes. There is an ongoing obligation under the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992 (the Settlement Act) to give recognition to the use and management practices of Māori in the exercise of non-commercial fishing rights. Several Māori communities have noted their concern that they have been deprived of fishing opportunities in more recent times because the quality and quantity of eels has diminished, particularly since commercial fishing commenced.

113 In view of the obligations under the Settlement Act, and the requirement to act consistently with that Act when making decisions under the Act, MFish propose that customary harvest be provided for in full when allowing for customary fishing. Further, the Minister agreed that the intended outcome of the management strategy for the North Island eel fishery was to improve the availability of eels to non-commercial users.

114 Within the freshwater environment of the North Island, customary fishing activities presently relate to the taking of aquatic life for hui and tangi only.

Recreational fishing purposes

115 Eels are a significant recreational resource. The main use of eels taken under recreational fishing purposes is for subsistence. Several rural communities live off the land, and continue fishing practices that have been handed down through generations. The quantities of eel taken have diminished in recent decades as the commercial fishery developed to a level where recreational fishing was not as successful as commercial fishing activities. However, reductions in recreational catch may also relate to the fact that Māori have become increasingly urbanised, and Maori are the predominant user of North Island eel stocks.

116 In earlier decades the eel fishery was affected by land management practices, the legacy of which continues today in many instances (flood protection works, river channelisation, drainage, dams, culverts etc). Habitat modification is still a feature affecting the resource in an incremental way but at a more modest scale. In recognition that habitat modifications have played a part in changing the status of the resource, a reduction factor was applied in calculating a recreational allowance for each of the North Island eel stocks at

the time of QMS introduction in 2004. However, significant reductions in the size of the resource, recruitment levels, population size structure, and changes to sex ratio and species composition over recent decades (ie, post 1965) coincide with intensive levels of commercial fishing activity.

117 The allowance provided for recreational fishing purposes also needs to recognise the importance of eel taken for subsistence purposes. Māori have expressed a clear desire over a long period of time to see their non-commercial fishing activities improved, and they continue to emphasize that commercial use of the eel resource is a secondary consideration to their primary requirements to feed their people, and look after the taonga that eels represent.

118 The prominence of non-commercial values has been encapsulated in the high level management strategy developed for the North Island eel fishery on its introduction into the QMS in 2004. The previous Minister agreed that one of the intended outcomes of the management strategy was to improve the availability of eels to non-commercial users. Such outcomes can occur indirectly through improvements in the performance of the fishery (eg, better sized fish in a stock), or more directly through specific recognition of an allowance, or both.

119 A non-proportional allocation approach places emphasis on an outcome where recreational interests are maintained at present levels, and in the longer term improved. A proportional allocation approach places emphasis on achieving positive outcomes for recreational interests in the longer term, and foregoing some opportunities in the short to medium term. The present recreational allowances for eel stocks are quite low, and further reductions in this allowance could have significant impacts on the use of the resource.

Customary allowance

120 MFish does not propose to reduce the allowances for customary fishing purposes from the existing quantities for the reasons outlined in the preceding sections. MFish considers that fishing for customary purposes should be provided for in full.

Allowance for other sources of fishing related mortality

121 MFish does not propose to reduce the allowances for other sources of fishing related mortality. The current allowances range between 2 and 4 tonne for each stock. MFish does not have information showing that fishing related mortality will in the future significantly depart from the existing quantities provided for by this allowance.

Recreational allowance and Total Allowable Commercial Catch

122 There are two approaches to the allocation of the recreational allowance and the TACC. The first approach is to allocate on a proportional basis, such that both sectors contribute equally to the TAC reduction required. The second approach is to allocate on a non-proportional basis, such that the quantity of fish available to one sector is not reduced, or not reduced to the same degree, as the other sector.

123 Allocation on a non-proportional basis would be more consistent with the intention of the management strategy for North Island eel stocks, and the values expressed by most Māori and others who fish for recreational or subsistence purposes. More generally, it is understood that the taking of eels for recreational fishing purposes contributes to people's well-being, and that the extent of that loss has been significant in recent decades.

124 The well-being of people wishing to eat eel is not readily satisfied by purchasing eels from New Zealand supermarkets or other wholesale or retail outlets. Almost all commercial eel catch from New Zealand is exported. A recent study in the Waikato has shown that the consumption of eel by Māori contributes to their well-being through a reduction in type 2 diabetes. Eels have been found to contain high levels of the omega-3 fatty acid that acts as a protectant against type 2 diabetes. These potential health benefits for the New Zealand public have not been fully realised or considered when assessing relative values to the recreational and commercial sectors.

125 Tables 1-4 provide both proportional and non-proportional options for allocation when calculating the recreational allowance and TACC for each stock. Four options are presented for each stock, having considered that there are two TAC options to firstly consider before reaching a view on what the recreational allowance should be. Some rounding of tonnage figures to whole numbers was necessary in some instances.

Northland / Auckland (QMA 20)

126 Table 1 summarises the options for allowances and TACCs for SFE 20 and LFE 20. Other than the general observations about which allocation approach might best meet the purpose of the Act, there are some specific observations about the fishing interests in the Northland/Auckland quota management area that can be made.

127 Firstly, according to the 2006 Census, the largest iwi in New Zealand is Ngapuhi, with 122,211 people. Not all of these people live in Northland though. Almost one-quarter of Māori in New Zealand live in the Auckland region, and within this urban environment, eel fishing is unlikely to be a significant past-time. Nevertheless, there is a reasonably high proportion of Māori within the Northland population (ie, greater than 25%), such that eel fishing would be a common activity. There are several tribes in Northland who have a particularly strong affinity to eels (eg, Ngati Hine).

128 Based on use of the eel resource since October 2004, the commercial use of either SFE 20 or LFE 20 stocks would not be significantly affected if TACCs were adjusted to levels proposed under shortfin option 1 or longfin option 1. The impact at shortfin option 2 is relatively minor, whereas the impact of longfin option 2 requires some shifting of fishing effort away from longfin.

Waikato / Poverty Bay (QMA 21)

129 Table 2 summarises the options for allowances and TACCs for SFE 21 and LFE 21.

130 This quota management area encompasses many of the ten largest iwi in the country, specifically Ngati Porou (71,910 people), Te Arawa (42,159), Ngati Tuwharetoa (34,674), Ngati Maniapoto (33,627), Waikato (33,429), Tuhoe (32,670), and Ngati Awa (15,258), as identified in the 2006 Census. There are many rural and provincial communities in the quota management area, and greater access to a range of waterways including wetlands, drainage systems, and artificial impoundments.

131 Based on use of the eel resource since October 2004, the commercial use of either stock would not be significantly affected if TACCs were adjusted to levels proposed under shortfin option 1, longfin option 1, or shortfin option 2. The commercial use of longfin under longfin option 2 may result in commercial fishers changing their fishing patterns or behaviours by a reasonable degree.

Hawke Bay / Wellington (QMA 22)

132 Table 3 summarises the options for allowances and TACCs for SFE 22 and LFE 22.

133 This quota management area encompasses an area associated with the third largest iwi in New Zealand – Ngati Kahungunu, who number 59,946 people (Census 2006). There are other smaller iwi in the Wellington, Horowhenua and Manuwatu areas that highly regard the carrying out of eel fishing activities in particular locations.

134 Based on use of the eel resource since October 2004, the commercial use of either stock would not be significantly affected if TACCs were adjusted to levels proposed under shortfin option 1 or 2, or longfin option 1. Some change in fishing behaviours would be required if longfin option 2 was adopted.

Taranaki / Rangitikei (QMA 23)

135 Table 4 summarises the options for allowances and TACCs for SFE 23 and LFE 23.

136 The existing recreational allowances are relatively small. Eel fishing for subsistence purposes continues to be an important pastime for local Māori. If the recreational allowance was reduced for either or both stocks in this quota management area, then recreational fishing activities would need to be better quantified and closely monitored.

137 Based on use of the eel resource since October 2004, the commercial use of either stock would not be significantly affected if TACCs were adjusted to levels proposed under shortfin option 1 or 2, but there would be an increasing level of economic impact for TACCs adopted under longfin option 1 and longfin option 2. Under longfin option 2, the commercial use of longfin in this stock would be significantly altered.

Socio-economic considerations

Potential impacts on non-commercial interests

138 The cultural connections of Māori to eels are significant. Eels are used in exercising customary fishing practices and are a distinct part of their cultural identity. Māori continue to express concerns that their cultural values have been affected by the diminished quality of the resource. If the customary allowances were maintained at existing levels, these values would not be further affected. Conversely, if the fishery was to improve at the TACs eventually adopted, the quality of the catch, within the allowance provided, should improve.

139 Non-commercial use of the eel fishery in the North Island has diminished as a result of reduced availability of eels of both a desirable size, and relative abundance. The non-commercial uses associated with the eel resource require restoration if social, economic and cultural well-being outcomes are to be enhanced.

140 A reduction in the recreational allowance may require initiatives (eg, rāhui) to ensure that the relevant allowance is not exceeded. MFish would firstly wish to better establish the existing non-commercial use of the resource, and the nature and extent of fishing and conservation practices. Fishing activities for subsistence purposes have a degree of self-regulation. People are less inclined to fish as much as they used to if the relative success of their fishing experience is low.

141 As some communities have already implemented measures to conserve local eel resources, these may need to be extended to apply for a longer time, and over a wider area. Implementation of such voluntary measures will cause some concerns, as the way of life in the community and the intangible values associated with the use of eel resources will be affected. Some people may elect to rely less on the use of eel resources as part of their subsistence lifestyle, and substitute eel resources for more grocery goods. This could have economic consequences to those people.

142 Eels are also used in a subsistence manner by the Asian ethnic group, particularly in South Auckland (ie, in SFE 21 and LFE 21 stocks). There may be an increased need to focus education and compliance resources toward this sector.

Potential impacts on commercial interests

143 Table 8 summarises the range in TACC reductions for each of the stocks and the potential economic loss relative to recent commercial catches. The proposed reductions in TACs will have little current affect for several of the TACC options discussed. This is because recent catch has not reached the TACCs set for most of the stocks. The potential economic loss expressed in the fourth column of Table 8 is somewhat theoretical, as it may not be realistic to expect that commercial catch would meet the existing TACCs for any sustained period. In any case, the figures produced in the last column of Table 8 represent the financial impacts should the smallest TACC option be chosen for a stock. Should the Minister decide to pursue a less conservative TAC and TACC for a stock, the financial impact will be much lower.

Table 8: Potential economic loss ($) for North Island eel stocks using port price and export price, where proposed TACCs are reduced below actual average commercial catch (based on catch in 2004-05 and 2005-06 fishing years).

Stock	Range in TACC reduction (t) from prior levels	Port Price ($/kg)	Export Price ($/kg)	Potential economic loss ($) based on TACC reduction from actual average commercial catch using port price and export price (actual tonnage reduction in brackets)	
SFE 20	27 – 63	3.87	8.37	$0	(0)
LFE 20	19 – 28	3.88	8.37	$27,160 - $58,590	(7)
SFE 21	14 – 29	3.87	8.37	$0	(0)
LFE 21	15 – 32	3.88	8.37	$58,200 – $125,550	(15)
SFE 22	6 – 14	3.87	8.37	$0	(0)
LFE 22	12 – 20	3.88	8.37	$23,280 – $50,220	(6)
SFE 23	6 – 14	3.87	8.37	$0	(0)
LFE 23	21-32	3.88	8.37	$58,200 - $125,550	(15)

144 The proposed TAC and TACCs seek to improve value over the medium term as stocks rebuild, such that the quality of the catch is improved, and the efficiency with which it is caught is improved. The reality, and the challenge, is to make such improvements more tangible in terms of economic return, even though the quantity of eels able to be caught commercially is proposed to be reduced.

145 The extent to which one commercial fisher is affected by TACC reductions over another, depending on the relative use of their quota shares or ACE in a particular stock, is not a relevant matter. Some commercial fishers will however decide to leave the fishery, or reduce their involvement to a part-time basis. Some of these commercial fishers may be recent entrants who are not as experienced as longer term participants, or some longer term participants in particular localities. The relative dependence of some commercial fishers on the eel fishery as a source of income is less than others. In such circumstances, some commercial eel fishers will be more able to readily leave the fishery, and the impact of a TACC reduction will not be of significant consequence.

146 The commercial fishery is seasonal, particularly in the lower North Island, when water temperatures drop in winter months. Consequently, commercial eel fishers in the southern North Island are more likely to have multiple income streams throughout the year. Commercial eel fishers in these stocks are therefore more likely to be able to adjust their employment commitments between eel fishing and other occupations.

147 MFish does not believe that the TACC proposals will significantly affect the viability of existing processing operations, or export markets. Processing facilities for eels have downsized over the recent history of the commercial fishery. Economic value can be improved if harvesting strategies focus on ensuring that the harvested population is in a good condition for subsequent processing.

Shortfin stocks

148 In the case of shortfin stocks, there is little or no impact on the overall quantity that may be commercially fished under the TACC options canvassed, in comparison to the average recent commercial catch (ie, 2004-05 and 2005-06 fishing years). Consideration of trends in commercial catch in the current 2006-07 fishing year do not significantly differ from the two most recent fishing years.

Longfin stocks

149 The impact of reducing the opportunities for commercial fishing of longfin stocks is of some economic consequence, if the lowest TACC options are chosen. This impact may be able to be offset as commercial fishers shift their fishing effort to the shortfin fishery, depending on the TACCs set for those stocks. Similarly, rather than altering their portfolios of quota shares or ACE, commercial eel fishers may elect to change their fishing patterns to fish in areas that are less likely to catch longfin.

150 Over the short term ACE prices for longfin stocks are likely to increase as the availability of ACE for these stocks are reduced. However, commercial eel fishers are unlikely to exceed ACE limits, and face deemed values penalties. Commercial fishers may return longfins to the water that can survive provided this is done as soon as practicable after it has been taken. Such returned catch is not counted against ACE.

Other management measures

151 Proposals to reduce catch limits of North Island eel stocks seek to provide better outcomes in terms of both sustainability and utilisation. Available information suggests that the level of harvest needs to be reduced so that sufficient eels reach a size where they undertake their spawning migration at the end of their life, and therefore the fishery can be sustained. This is particularly important for female longfins that migrate at a larger size. In turn, and while acknowledging that a stock recruitment relationship is not known, there is a greater probability that glass eels and subsequently elvers will recruit to the fishery. This should increase abundance and therefore availability of eels.

152 Similarly, reducing the level of harvest should increase the average size of an eel within a population. With an increase in average size, the proportion of eels reaching migratory size should improve, as well as improving yield per recruit (ie, fishers prefer larger individual eels). A healthier population structure, with eels represented at a broader range of size classes including

large eels, should also have benefits for the aquatic environment and inter-related stocks.

153 Ensuring that a sufficient number of eels reach a large size can be done in a number of ways and MFish is using a range of complementary tools for this purpose. Catch limits can be seen as an efficient primary measure, which influences the nature and extent of the use of other complementary tools.

154 Commercial fishers are no longer able to take an individual eel weighing more than 4 kg. This measure has only recently been extended to apply to commercial fishers across the country. This measure could be extended to recreational fishers if it was felt that fishing pressure from that sector was compromising the objective of improving spawning escapement. MFish has raised this as an option previously, but the concerns of non-commercial stakeholders were not necessarily focused on the relative merits of such an option for the future. Furthermore, whether the extent of non-commercial fishing is presently at a scale where spawning escapement improvements are being compromised could usefully be assessed.

155 Some stakeholders have suggested that minimum size limits, and escapement tube diameters, should be increased (or introduced for the recreational sector) in order that better yields are derived from each eel taken. MFish believes that there are a variety of ways to improve fishery outcomes, but the purpose and inter-relationship of such initiatives (eg, availability, managing densities and sex ratios, spawning escapement), needs to be better explored through a fisheries plan. There may be more flexible ways to achieve some of these outcomes. Reducing catch at a stock level can be a more direct way to achieve some of these outcomes, and it can be achieved relatively simply under the QMS. Recreational fishers are already subject to a bag limit of six eels per person, and a limit of one net per person.

156 Commercial fishing activity has also been recently prohibited from various catchments, with a view to creating more refuge areas where eels can reach migratory size without being vulnerable to commercial fishing. MFish has signalled that it intends to consider the prohibition of commercial fishing from further catchments in the future for this purpose. MFish intends to explore further options through the fisheries plan process.

157 Finally, it is important to recognise that the review of catch limits looks to address a broader range of management outcomes than just spawning escapement, albeit that this is particularly important for any subsequent utilisation values. Controlling catch is an effective primary tool where limits are appropriately set for sustainability purposes.

Statutory Considerations

158 In forming the management options for North Island eel stocks, the following statutory considerations were taken into account.

159 **Section 8:** The purpose of the Act is to provide for the utilisation of fisheries resources while ensuring sustainability. The proposed management options

seek to ensure sustainability of respective eel stocks by setting a TAC that improves the population structure and abundance over the medium term, while bringing a halt to any decline in the fishery over the short term, such that the fishery:

a) is sustainably managed;

b) its availability to non-commercial fishers in particular is improved; and

c) the relationship with interdependent stocks is also improved.

160 On balance, the revised management settings for all North Island eel stocks are likely to better enable people to provide for their social, cultural and economic aspirations, although the benefits to some stocks may take time to materialise. Social, cultural and economic considerations of generic application follow:

a) Enabling people to provide for their social and cultural aspirations are of particular importance for this fishery. The eel fishery is one of the most important for Māori on a cultural basis, as it forms a key element of their customs, and is considered a taonga or treasure. This value extends to social considerations, as the species is taken on a non-commercial basis as a source of food. Eel fishing is also a leisure activity enjoyed by outdoor enthusiasts. The level of use of the fishery by the commercial sector over the last 40 years is likely to have impacted on the ability of non-commercial interests to meet their social, cultural, and economic aspirations;

b) The eel fishery in the North Island forms the basis of a moderately small sized commercial fishery that provides direct employment for commercial fishers, many of which operate on a part-time or seasonal basis, although processing at least two of the three main factories occurs year round;

c) Economic impacts for the fishing industry in the short term are dependent on the TAC and TACC options chosen. The impacts at the level of the stock are of modest direct consequence for options that bring catch limits to within recent catch. Improved stock structure and abundance will lead to increased economic efficiencies in the medium term, something that is likely to be welcomed by the eel industry. Over time, improvements in CPUE will further reduce the relative costs associated with undertaking commercial fishing.

161 **Section 14:** Section 14 of the Act provides that the Minister may set a TAC for a stock other than in accordance with s 13(2) of the Act (ie, at or above a biomass level that would produce maximum sustainable yield), where the Minister is satisfied that the purpose of the Act would be better achieved. This section may only be used for stocks having particular characteristics or management arrangements that make standard fishery stock assessments inappropriate.

162 In the case of North Island eel stocks, it was determined in 2004 that a sufficient level of information was not available to have confidence that TACs could be set under s 13(2) of the Act. To better serve the purpose of the Act under s 14, the previous Minister agreed to a management strategy for North

Island eel stocks to guide the setting of TACs. The information used to develop the proposals in this paper further support the intention of the current management strategy.

163 **Section 11(1)(c):** Eel fisheries are typically not subject to significant natural variability in their biomass to the extent that stocks become susceptible to overfishing on this basis alone. This is the case for all North Island eel stocks. The longevity and relatively slow growth rates experienced by eels in most waters, coupled with their reduced activity over winter months in southern North Island waters, plus the limiting factor of available habitat for larger eels, further reduces the scope for significant increases in biomass over the short term.

164 **Section 9(a) and (b):** The nature and extent of bycatch of any associated or dependent species in this fishery is not considered significant – it is likely that most species can be released unharmed given the use of the fishing methods employed. A reduction in overall harvesting pressure as provided by the TACs proposed is likely to assist in maintaining biodiversity. The presence of large eels, as top predators in the food chain, is likely to be of particular significance. Reducing TACs as proposed will contribute to an improvement in population structures, and an increased proportion of large eels in a stock. The presence of large eels may inhibit the numbers of introduced fish species in localised areas.

165 **Section 9(c):** No habitats of particular significance for fisheries management have been identified within the North Island that would be at risk as a result of eel fishing. It is considered unlikely that the fishing methods employed to take eels would have a demonstrable adverse effect on such habitats. Stakeholders will however need to ensure that they adopt practices that avoid the unintended transfer of aquatic life from one catchment to another. MFish also notes that a range of habitats of particular significance for fisheries management have been protected to varying degrees under other legislation for other purposes (eg, National Parks Act 1980, Reserves Act 1977), so that fishing is restricted in those areas.

166 **Section 11(1)(a):** The effects of fishing on any stock and the aquatic environment are covered in the preceding paragraphs on section 9 considerations. MFish considers that the effects of fishing on all North Island eel stocks and interdependent stocks require some attention.

167 Interdependent stocks include both the associated species within the food web where eels are a key species, as well as other eel stocks, either within the same quota management area, or in other quota management areas. MFish is aware that the finfish species composition of some aquatic habitats in the northern North Island (eg, Waikato) has undergone significant change over at least the last 30-40 years, primarily as a result of fishing pressure. As a result of these changes:

a) introduced species have changed the ecological structure of the biological community; and

b) historical commercial fishing activity has reduced the number of large eels (particularly longfin), and proportionately increased the number of shortfin. Further, relatively narrow population size structures, and potentially higher densities of smaller to moderately sized eels, have resulted.

168 These outcomes are likely to further affect species assemblages, sex ratios, and productivity of eel fisheries, in addition to any more far-reaching impacts on the sustainable use of other longfin stocks (eg, relative success of spawning escapement and subsequent recruitment). Stakeholders will need to contribute to the further specification of these issues such that TACs or other management settings can be adjusted to meet these matters over time.

169 **Section 5(a):** There is a wide range of international obligations relating to fishing (including sustainability and utilisation of fishstocks and maintaining biodiversity). MFish considers issues arising under international obligations are adequately addressed in the management options proposed for North Island eel stocks, noting that the legislative framework under the Act provides on-going scope to address issues that might arise from international obligations. Furthermore, the current proposals represent a further step in a direction where sustainability, utilisation and biodiversity values are improved.

170 **Section 5(b):** MFish considers that the management measures proposed are consistent with the provisions of the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992. MFish notes its on-going obligation to ensure that non-commercial Māori fishing interests are provided for in this and any subsequent review of management settings.

171 **Section 11(1)(b):** The existing controls that apply to eel stocks in the North Island include catch limits and allowances as part of being managed under the QMS, Sixth Schedule listing that provides for the return to the water of unwanted commercial catch, closed areas, a minimum and maximum legal size for commercial fishers; and a requirement for escapement tubes of specified diameters to be inserted in fyke nets used by commercial fishers. Recreational / subsistence fishers are limited to a bag limit of six eels per day, and may not use more than one fyke net or hīnaki per person. While a person fishing recreationally need not have escapement tubes in their nets, they are limited to using a net with a mesh size of not less than 12 mm. At present, customary fishing purposes that may be authorised in freshwaters of the North Island are limited to fishing for hui and tangi only.

172 **Section 11(2A)(b):** No fisheries plans under s 11A of the Act exist for any of the North Island eel stocks.

173 **Section 11(2A)(a) and (c):** For the North Island eel fishery, the revision of catch limits in each quota management area are not considered to warrant an immediate need to generate or withdraw fisheries or conservation services for any of the relevant stocks. The draft medium term research plan for the national eel fishery outlines research directions already adopted by MFish. No decision has been made not to require a service in this fishery. The level of

conservation or fisheries services that might be required will depend on the range and level of risks associated with the use of any particular fishery. The range and level of risks associated with use at the proposed catch limits discussed in this paper are not so significant to change the level of services required in the short to medium term.

174 **Section 11(2)(a) and (b):** There are no specific provisions applicable to the coastal marine area known to exist in any policy statement or plan under the Resource Management Act 1991, or any management strategy or plan under the Conservation Act 1987, that are relevant to the varying of sustainability measures, such as the catch limits, for North Island eel stocks.

175 **Section 12(2)(c):** Before setting any sustainability measure relevant to the Hauraki Gulf (eg, a TAC for the SFE 20, LFE 20, SFE 21 or LFE 21 stocks), the Minister must have regard to s 7 and s 8 of the Hauraki Gulf Marine Park Act 2000. The Hauraki Gulf is defined in that Act to include all coastal waters and offshore islands from near Te Arai Point (south of Mangawhai) offshore to the Moko Hinau Islands, and south to Homunga Point (north of Waihi Beach). This Act's objectives are to protect and maintain the natural resources of the Hauraki Gulf as a matter of national importance.

176 The varying of sustainability measures for the four eel stocks having part of their areas common to the Marine Park area will further the objectives set out in s 7 and s 8 of the Hauraki Gulf Marine Park Act 2000, and ensure that the range of values associated with the use of the eel resource are enhanced for the people and communities in the area. Eels, particularly shortfin, are taken both on a non-commercial and commercial basis in estuarine and salt waters of the Marine Park. As the proposed measures seek to reduce the amount of take for the relevant eel stocks for the purposes of sustainability, MFish considers that this is consistent with protecting and/or enhancing the life supporting capacity of a natural resource found within the Gulf.

177 **Section 21(1)(a and b) and (4)(i and ii) and (5):** The nature of the fishery and the interests of the respective fishing sectors have been considered in setting the allowances for recreational and Māori customary interests and the TACC, and all other mortality to the stock caused by fishing. No mātaitai exists in any of the quota management areas that would materially affect eel fishing. Area closures or fishing method restrictions applied under s 186A of the Act for customary fishing purposes are limited to small coastal areas that are not the subject of eel fishing, or the restrictions apply to species other than eels. No restrictions on commercial fishing have been implemented in any area within any of the North Island eel stocks for recreational interests arising from s 311 of the Act.

178 **Section 10:** MFish has used a variety of information sources to contribute to the development of this paper. Some of these are written accounts drawn from a range of disciplines, including:

a) reports provided for purposes other than strictly fisheries management;

b) a reasonably extensive range of research reports on the fishery conducted for either MFish or other agencies over the last decade; and

c) an array of oral accounts to MFish staff over many years that trace the historical or present uses and values of the resource. Such observations may have been made through attendance at hui, convening of workshops and seminars, personal interactions with a range of stakeholders, and first hand experience.

179 There is a reasonably extensive amount of information on the fishery and its uses sufficient to make the recommendations contained in this paper. However, there are some areas where information is uncertain or inadequate, such that a cautious approach should be adopted. The approach taken should further the purpose of the Act by ensuring that sustainability settings are sufficiently robust to allow for a rebuild of all North Island eel stocks over the medium term. Within that context, there is a greater probability that utilisation opportunities in the future will be improved. On-going review of new information will be required.

180 On a scientific basis, comparative quantitative information on the status of the resource does not extend as far back as desirable, given the longevity of each species. Research findings, although not necessarily conclusive in all cases, or representative of all areas, are suggesting that trends in recruitment, population size structure, harvest rates and spawning escapement are of concern and/or warrant particular consideration. This is particularly so for longfin stocks. Further, there is a lack of scientific information on the role of eel species in maintaining biological diversity, and quantitative information on their relationship with associated and dependent species.

181 There is reasonably good information about the use of the fishery by the commercial sector, but quantification of the non-commercial use of the resource has not been attempted at the level of a stock, or extensively at other scales. Development of a method for assessing non-commercial catch is the subject of a current research project. Oral accounts of the importance of the resource for non-commercial stakeholders have been considered in developing this paper.