Ministry of
Fisheries
Te Tautiaki i nga tini a Tangaroa

EEL FISHERIES PLAN

(Information document: North Island)

2008-09
(Last updated 24 / 02 / 2009)

Table of Contents

EXECUTIVE SUMMARY

1 The creation of a fisheries plan for the freshwater eel fishery enables fishery interests and the Ministry of Fisheries (MFish) to share a common vision about how the value of eels can be maximised within and between sectors in the context of the purpose of the Fisheries Act 1996 (the Act). The purpose of the Act is to provide for utilisation while ensuring sustainability. The aim of the fisheries plan for eels is to develop management objectives for the fishery, to specify the services required to meet the objectives, and to stipulate the manner in which fishery interests and MFish will monitor the performance of the actions taken to deliver on the objectives for the fishery.

2 The biological characteristics of eels make them interesting species within the aquatic environment. Three eel species are found in New Zealand. The longfin eel (*Anguilla dieffenbachii*) is found only in New Zealand, while the shortfin eel (*Anguilla australis*) is found in Australia and various South Pacific Islands. The Australasian longfin eel (*Anguilla reinhardtii*) is principally found in northern and eastern Australia. Only small numbers have been confirmed as being present in northern New Zealand. Eels are generally long-lived, and only breed once at the end of their lifecycle, having migrated to an oceanic breeding area. Large eels are the top predator within the freshwater ecosystem.

3 Eels have been used and highly valued by a number of generations of New Zealanders. Eels have always been important to Maori for sustenance, and as a part of their traditional customs. Non-Maori also regarded eels as an early food source, particularly in the colonial years. Recreational use of eels continues to be a feature of outdoor life today. Commercial eel fishing increased in the mid to late 1960s to the extent that a significant annual harvest from across the country was maintained for the following decades.

4 Concerns about the extent of the harvest have led to a range of fisheries management controls being adopted over time. Earlier measures applied in the 1980s have since been replaced with more effective management controls since 2000. The earlier measures were designed to control fishing effort in the fishery, prior to the more direct means of controlling catch from the fishery. The changing management arrangements of recent times have sought to address the sustainability and utilisation concerns held for the fishery. The opportunity is now available for interested parties to work together with MFish to set out the fisheries management work programme for the longer term.

5 Eels are also subjected to a range of non-fishing impacts that are of significance. Eels are killed through the mechanical clearance of drainage channels and damage by hydro-electric turbines and flood control pumping. Eel populations are also likely to have been significantly reduced by wetland drainage, and habitat modification brought about by irrigation, channelling of rivers and streams, and the reduction in littoral habitat. Most of these activities are controlled under the Resource Management Act 1991, and are beyond the scope of this plan.

6 The first stage in the development of a fisheries plan is to set out the current management settings for the eel fishery. This document does this for the North Island. Latter sections of the fisheries plan will be completed by MFish once it has canvassed the views of interested parties about management objectives for the fishery, the means to deliver on them, and monitor their performance.

PURPOSE OF THE PLAN

7 The fisheries plan for eels will be developed collaboratively between the Government, tangata whenua, and stakeholders in order to maximise the value that New Zealanders obtain through the sustainable use of eel resources and protection of the aquatic environment.

8 This fisheries plan is incomplete. The available information and outcomes for the fishery represent the Government's perspective. Completion of the plan requires collaboration with tangata whenua and stakeholders to ensure the best available information on the current situation is available for consideration. Stakeholder collaboration is also required to develop and/or further refine management objectives, assess the fishery, recommend management measures and propose an operational plan for the future management of the fishery.

9 Management measures proposed through individual fisheries plans will be prioritised against measures proposed in other plans for implementation. Once the plan is operational, MFish, tangata whenua, and stakeholders will be able to monitor and review it. The fisheries plan will be fully reviewed at appropriate intervals in the future to update the best available information, review objectives, re-assess the fishery, and develop new management measures.

SCOPE OF THE FISHERIES PLAN FOR EELS

10 The scope of this document relates to the following freshwater eel species found in the North Island of New Zealand:

a) longfin eel (*Anguilla dieffenbachii*);

b) shortfin eel (*Anguilla australis*);

c) Australasian longfin eel (*Anguilla reinhardtii*).

11 The endemic longfin eel is found throughout the country, including its offshore islands. The shortfin eel is found throughout New Zealand, eastern and south-eastern Australia, New Caledonia and other island groups of the South Pacific.

12 In 1996 the Australasian longfin eel was confirmed as present in small quantities in commercial fishing landings from the upper North Island. While the scope of this plan includes three species, the main emphasis is on the shortfin eel and longfin eel. There is little information available about the Australasian longfin eel in New Zealand. Given similar growth characteristics, the latter species is managed as a component of the shortfin eel fishery.

13 This plan only covers eel stocks in the North Island (Figure 1), despite the national distribution of eel species in New Zealand, and the migration of both longfin and shortfin eels to and from an unknown spawning location offshore in the southwest Pacific. This document should be read in conjunction with a similar document for South Island eel

stocks, noting that many of the management strategies to meet the purpose of the Act are common throughout.

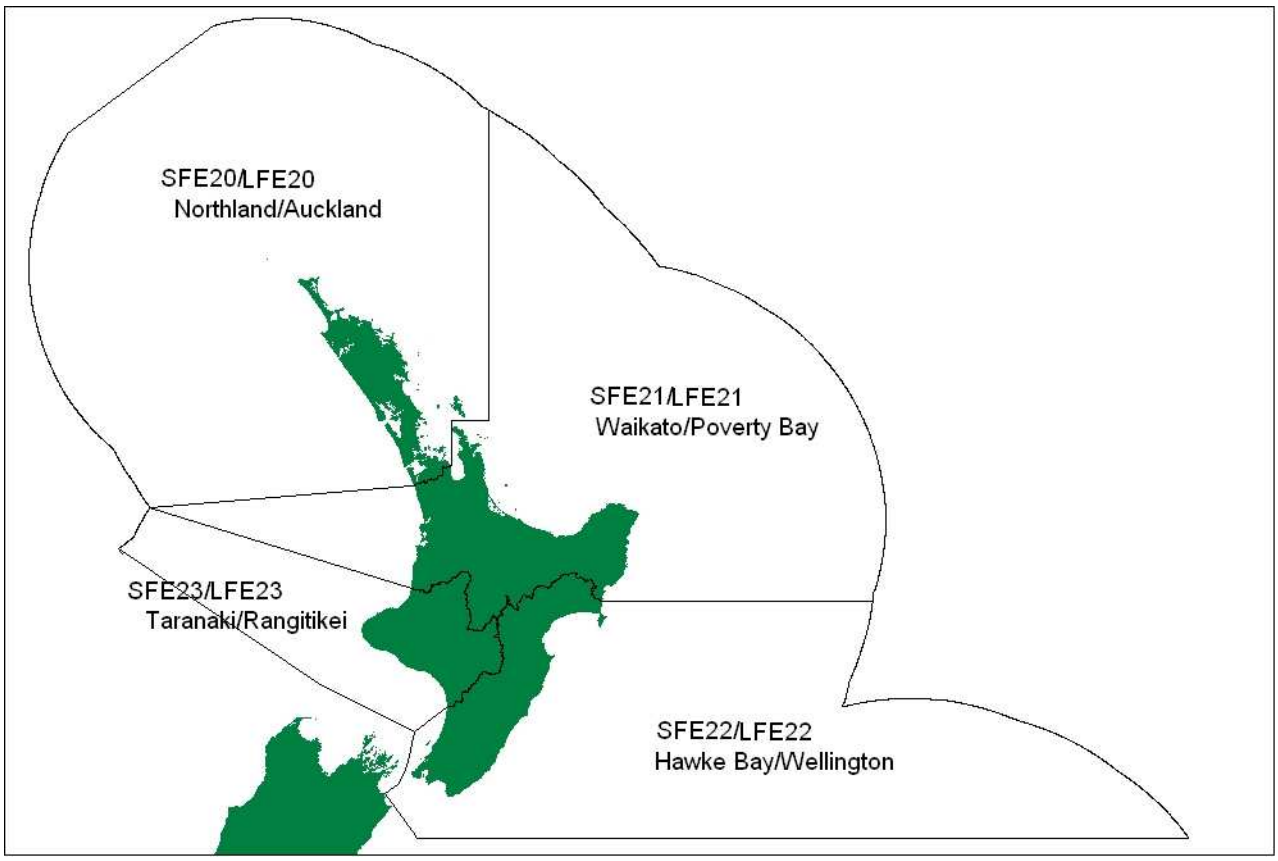

Figure 1: Quota management areas for shortfin and longfin eel stocks of the North Island.

14 This plan should also be considered in conjunction with the national freshwater plan for species other than eels, and the Chatham Island plan that encompasses both marine and freshwater species.

SECTION 1: THE CURRENT SITUATION

15 The section outlines the current situation for eel stocks in the North Island by providing the best available information about the three broad outcomes contained in the MFish 'Statement of Intent' document, as follows:

a) health of aquatic environment protected;

b) best value able to be realised;

c) credible fisheries management.

Health of Aquatic Environment Protected

Biodiversity

General context

16 The direct impact of eel fishing activities on the biological diversity of the aquatic environment is low. The direct modification of habitat for other purposes unrelated to fishing activities (e.g. farming, flood control, irrigation, drain clearance, dams and culverts) is likely to be of more consequence. However, fishing activities are likely to be of consequence to biodiversity in an indirect way.

Eels as a top predator

17 As a top predator, eels are important in determining the trophic structure of the aquatic environment, and therefore have a role in maintaining biodiversity. At a certain size, the diet of eels shifts from aquatic insects and snails to a greater emphasis on fish species including small eels. The loss of a significant proportion of large eels from an area may therefore influence the abundance and inter-relationships between prey species. For example, the number of goldfish present in Lake Omapere (Northland) has increased since the population of eels was significantly reduced over a short period in 2000 and early 2001.

18 A significant displacement of large eels may also enable introduced species to fulfil a similar role as a predator (e.g. brown bullhead catfish), but the actions of these species may have negative impacts on the aquatic environment. For example, the distribution and abundance of these other predatory or omnivorous fish may increase, to the broader detriment of the aquatic environment, including possible effects on biodiversity values associated with native species. Further, the foraging activities of some introduced species (eg, koi) are likely to be particularly destructive to native freshwater habitat values of particular significance for fisheries management. Accordingly, the role of large eels in maintaining biodiversity is an important factor to consider when setting sustainability measures for the eel fishery.

Measures to maintain biodiversity

19 MFish has a statutory obligation under the Act to maintain biological diversity. There are a number of tools available under the Act to achieve this obligation. Examples where biodiversity values are enhanced under the Act include the closure of areas for fishing access, the catch limits applied to the taking of the stock, and the use of a maximum size limit.

20 Other than measures that MFish may take to deliver on its statutory commitment to biodiversity, there is a range of other statutory controls under other legislation that support the objective of maintaining biodiversity (eg, National Parks).

Risk associated with fishery use

21 As the eel fishery is mainly undertaken in the freshwater environment there are a range of different risks associated with its use in comparison to resources fished from the marine environment.

22 Certain introduced species of plants and animals taken in fyke nets or hīnaki may be accidentally or deliberately transferred to locations where those species do not exist. There are laws in place that prohibit the transfer or release of live aquatic life into freshwater without an appropriate authority.

23 The risks of species being transferred to new locations can be mitigated. For example, brown bullhead catfish must be killed on capture by amateur fishers, while commercial fishers cannot sell live brown bullhead catfish. This will ensure that live catfish are not made available to the market, reducing the risk that people do not dispose of live catfish to the wild.

24 There are other measures available to reduce the risk that early lifestages of various species are not transferred or released into the wild (eg, periodic salt bath of fishing gear used in freshwater, washing down trailers before being used in another major catchment area). MFish developed a Code of Practice to reduce the risk of catfish being distributed to other waters in October 2007.

Benthic Impacts

25 Eel fishing is a reasonably benign activity and fishing methods have little known physical impact on the benthic environment.

Habitats of particular significance to fisheries management

26 Eels occupy a broad range of habitats. The range of habitat types found within freshwater systems in New Zealand is gradually being mapped by research providers.

27 As juveniles, eels are frequently encountered in flood plains and lowland lakes and estuarine areas, and may burrow into the sediment. The density of eels found is related to the slope and altitude of the habitat. Longfin eels dominate waters of higher altitude and slope, and vegetative stream bank cover is important for larger eels. Longfin eels are often found in the headwaters of many catchments. Where riparian vegetation or normal water flow characteristics have been modified, the ability of the habitat to support the full size distribution and number of eels within a population is likely to be affected.

28 Eels undertake a spawning migration towards the end of their lifecycle. To do this, eels require unimpeded access to the sea. The placement of barriers across rivers and lakes is a major problem where these structures do not allow for fish passage. Fish passage issues are the responsibility of Councils under the Resource Management Act 1991. Also, without adequate fish passage, juvenile eels may not be able to enter a catchment that earlier generations once had free access to. Further, their efforts to move upstream may be futile if an obstruction similarly affects their downstream migration. Further discussion of

the impacts of human activities on habitat values is outlined in the subsequent 'Other resource users' section.

Protected species

29 There are no protected species, as defined in the Act, found in conjunction with the fishery for eels.

Associated and dependent species

30 Maintaining associated and dependent species above a level that ensures their long term viability is one of the three environmental principles set out in section 9 of the Act. There is no information to suggest that species meeting the statutory definition of an 'associated or dependent species' have been affected by eel fisheries to such a level that their long term viability has been threatened.

31 'Associated and dependent species' are defined under the Act as any non-harvested species taken or otherwise affected by the taking of any harvested species. 'Harvested species' means any fish, aquatic life, or seaweed that may for the time being be taken with lawful authority. The extent of species deemed non-harvested varies depending on the laws applying to the taking of such species, and that varies according to whether the person taking the aquatic life is a commercial or non-commercial fisher, as well as other factors.

32 Cormorant or shag species, whether pied, black, or little black, are sometimes attracted to the movement of fish caught in fyke nets set in shallow water. These birds are partially protected under the Wildlife Act 1953, such that they generally may not be taken with lawful authority by either commercial or non-commercial fishers. Their capture is known more from northern waters of the North Island, but is likely to occur in suitable habitats elsewhere.

33 The following species are not able to be taken by a commercial fisher with lawful authority as a result of provisions in other legislation:

a) 'sportsfish';

b) 'unwanted aquatic life';

c) 'restricted fish';

d) 'Whitebait' (seasonally);

e) 'Koura'.

34 However, an authority to lawfully take some of these species may be granted to individuals from time to time eg, koi authorizations, restricted fish authorisations.

35 The following species are not able to be taken by a non-commercial fisher with lawful authority, as a result of provisions in other legislation:

a) 'Sportsfish' (without a licence applicable for the open season);

b) 'Restricted fish' (without specific authorisation);

c) 'Whitebait' (during closed season);

36 While non-commercial fishers are able to take a wider range of associated and dependent species, there are a couple of other species that are not able to be possessed in a live state. Upon capture, even as a bycatch of the eel fishery, non-commercial fishers must kill species such as koi and catfish.

37 There are a variety of species, not being associated and dependent species (partially or all the time), taken as a bycatch of the eel fishery. These include goldfish, flounders, mullets, and smaller species such as bullies or adult galaxiids.

38 The principal fishing methods used to take eels are quite target specific, and are unlikely to give rise to significant levels of catch of associated and dependent species. Methods such as gaff, hand-gathering, bobbing, and spear are very unlikely to result in any bycatch, while fyke net and pots / hīnaki are capable of taking a range of species. The range of associated and dependent species taken will vary according to the area of fishing activity. Some fish species taken are either more common (e.g. koi or trout in SFE 21 / LFE 21 stock areas) or absent in some areas of the North Island.

39 Eels were once considered a threat to the introduced trout fishery, and efforts were once made to cull eels or restrict their movement into waterways stocked with trout. However, research has since indicated that eels do not prey extensively on juvenile trout. The predatory behaviour of large eels on trout may also ensure that the population structure of prey populations is enhanced from an angling perspective. Large eels may remove weak trout or trout with stunted growth. MFish does not consider that the long-term viability of trout will be affected by eel management practices.

Other resource users

40 Eels are subject to significant sources of mortality due to non-fishing activities. The actual mortality from non-fishing activities has not been quantified.

41 Direct mortality occurs through the mechanical clearance of drainage channels and damage by hydro-electric turbines and flood control pumping. Hydro-electric turbine mortality is affected by eel length, turbine type and turbine rotation speed. The mortality of larger eels (specifically longfin females), is estimated to be 100%. Given the large area of water in hydro lakes, this source of mortality could be significant and have an impact on the number of eels migrating to sea in spawning condition.

42 Attempts were made to impede the progress of juvenile eels above hydro dams up until the early 1970s – mainly by trout fishing interests. The impact of these historical efforts on the current biomass of eels is not known. Efforts have since been made to improve fish passage past manmade obstacles in recognition that eel species are a valuable part of the ecosystem. However, the provision of adequate fish passage measures remains a significant problem in New Zealand, not only for eels, but also for a range of other indigenous species.

43 Eel populations are likely to have been significantly reduced by wetland drainage (wetland areas have been reduced by up to 90% in some areas), and habitat modification brought about by irrigation, channelling of rivers and streams and the reduction in littoral habitat. These effects were significant historically, and are of on-going concern. On-going drain maintenance activities by mechanical means to remove weeds may cause direct mortality to eels through physical damage or by stranding and subsequent desiccation. The

distribution of eels in some rivers may also be affected by a lack of protection of riparian vegetation, either through a lack of fencing on farms, or creation of adequate buffer zones near urban or forestry developments.

44 Land and water resource users normally require consent for many of their activities under the Resource Management Act 1991. Alternatively, some activities are described as discretionary, and no consent is required. The consenting requirements, if any, will depend on the Council's consideration of the importance of the issue within the geographical area of its responsibility. There does not appear to be any national overview of the combined impacts of habitat modification for species such as eels.

Harvest strategies

45 North Island eels stocks were introduced into the QMS on 1 October 2004. Total allowable catches (TACs) were set under s 14 of the Act. At the time, the Minister of Fisheries agreed that the management strategy for eel stocks in the North Island was to improve the stock structure (ie, size frequency distribution) and abundance of North Island eel stocks over the medium term, while bringing to a halt any decline in the fishery over the short term. This is intended to have the effect of ensuring sustainability, improving availability to non-commercial fishers, and improving the relationship with interdependent stocks. The management strategy was reconfirmed by the subsequent Minister in September 2007 in undertaking a review of catch limits for the 2007-08 fishing year.

Productivity

46 Both shortfin eel and longfin eel are considered to be species with low productivity, based on their natural mortality rate, fecundity, size and age at maturity, breeding strategy, maximum age and growth characteristics.

Natural mortality rate

47 Estimates of natural mortality are only available from two sites. Estimates for shortfin range from 0.038 - 0.042, whereas the estimate for longfin is 0.036.

Fecundity

48 Fecundity is an important consideration for management as the fishery is based on pre-spawning fish. Larger female eels are much more fecund than smaller female eels. Larger female eels potentially make a greater reproductive contribution by producing a higher proportion of eggs for potential recruitment to New Zealand fisheries waters, and other countries in the case of shortfin. For example, a female longfin eel of 4 kg in weight is likely to carry approximately eight million eggs, whereas a female longfin eel of 2 kg is likely to carry approximately 3.5 million eggs. The level of egg production to ensure sufficient recruitment of eels is unknown.

49 Female eels are long-lived and take several decades to reach reproductive maturity. Until they reach maturity and migrate to sea, eels are susceptible for a long period of time to fishing activities as well as mortality caused by non-fishing activities (e.g. drainage clearance, pollution events). Research using Geographical Information System (GIS) modelling has been undertaken to assess the amount and quality of habitat that is potentially available for eels across New Zealand. About 5% of longfin eel habitat is in

waters that are closed to commercial fishing and have safe egress for migrant females. Another 11% is in waters that are protected in their upper reaches but where migrant females could be fished further downstream and 17% is located in small streams that are rarely fished. In all, it is estimated that about 33% of present habitat in both the North and South Islands is either in reserves or is rarely fished.

Length and age at maturity

50 Age at migration may vary considerably between areas depending on growth rate. Males of both species mature at a smaller size than females. Migration appears to be dependent on attaining a certain length/weight combination and condition. Recorded age and length at migration for shortfin males is 5-22 years and 40-48 cm, and for females 9-41 years and 64-80 cm. For longfin eels, recorded age and length at migration is 11-34 years and 24-67 cm for males, and 27-61 years and 90-158 cm for females. However, because of variable growth rates, eels of both sexes and species may migrate at younger ages.

Maximum age

51 Maximum recorded age is 60 years for shortfin and 106 years for longfin.

Growth

52 Growth rates are usually linear. Growth in freshwater is highly variable and dependent on food availability, water temperature and eel density. Shortfin eels often grow considerably faster than longfins from the same location, although in the North Island longfins grow faster than shortfins in some areas. South Island shortfins take, on average, 12.8 years (range 8.1-24.4 years) to reach 220 grams (minimum legal size for commercial fishers), compared with 17.5 years (range 12.2-28.7 years) for longfins, while in the North Island the equivalent times are 5.8 years (3-14.1 years) and 8.7 years (range 4.6-14.9 years) respectively.

Sustainability indicators and stock status

53 There is no formal stock assessment available for freshwater eel stocks in New Zealand. The status of longfin eel is not known, although the recent changes to management settings should reduce the risk of further decline in relative abundance. Evidence from catch-per-unit-effort (CPUE) indices throughout New Zealand and observations of changes in length / weight, species composition, and sex ratios of eel populations suggest that eel stocks have significantly declined in recent decades. For the fishing years 2003-04 to 2005-06 shortfin landings in the North Island comprise from 69 to 77% of landed weight, which is higher than observed in the 1970s. Similarly, there is no clear trend of improvement in population size structure of either shortfin or longfin sampled from North Island commercial catch. On-going monitoring of the fishery is underway, which will gauge the effect of further reductions in commercial catch limits from 1 October 2007.

54 Estimates of current and reference biomass of longfin eel have recently been derived using GIS techniques that classified all waters throughout New Zealand. Field survey data of biomass per kilometre was extrapolated from field studies (212 sites) to all New Zealand waters, noting that biomass was strongly related to the mean annual low flow and gradient of the waterway in question. The biomass estimate of longfin eels in the North Island was the same as that for the South Island, at 6,000 tonnes each. The highest longfin eel

biomass was found in large rivers in coastal and lowland regions. Further, computer simulations demonstrated that fishing activities systematically reduced both the mean length and mean weight of harvestable eels (>220 g) and the total biomass of eels present.

55 Conventional modelling studies on eel populations in New Zealand are still relatively new. Initial results indicate that exploitation rates of 5 to 10% are sufficient to reduce the spawning per recruit of female longfins by 83% and 96.5% respectively. Longfin female eels are considered recruitment over-fished at these exploitation levels. Preliminary assessments indicate that exploitation rates prior to the application of the QMS may have previously been in this range. Initial catch limits applied to eel stocks since 2000 in the South Island, and 2004 in the North Island, have reduced these exploitation rates. Additional reductions in catch limits have been implemented for North Island eel stocks from October 2007 to further reduce the risk of recruitment over-fishing, and to allow more certainty in rebuilding eel stocks.

56 Some preliminary work has been undertaken in 2006-07 on development of a conventional, but suitably structured, population dynamics stock assessment model that may serve to provide a basis for future recommendations on catch limits. This model was developed for the Southland longfin eel fishery given the available information. In the medium term, refining the biomass estimates derived from the GIS modelling approach would also be of assistance. Some further evaluation of the modelling technique, and its potential application to other areas, and shortfin eel, has been undertaken during 2007-08 and 2008-09.

57 The MFish convened Fishery Assessment Working Group concluded in May 2008 that there remains a risk that the current harvest levels for longfin eels in particular, coupled with past and present anthropogenic impacts (ie, impacts other than fishing), are not sustainable. Based on available information, the Fishery Assessment Working Group did not consider that the same level of risk applied to shortfin eels.

Information status

58 The amount of information on the characteristics of the fishery and the means to monitor changes in relative abundance, size and age structure, and species composition has improved considerably since the early 1990s. The development of integrated stock assessment models for the eel fishery is dependent on the collection of such information over time, and further analysis of the feasibility of applying such models.

59 The level of information available to support management decisions for eels remains limited. MFish is committed to the collection of further information about the various eel stocks and species characteristics, particularly where the collection of such information is of assistance to understanding trends or informing management decisions at a range of levels.

Research

60 MFish has commissioned a considerable amount of research on the eel fishery over the last decade. MFish-commissioned research is documented in the report entitled "Freshwater Eel Fisheries: Chronology of Research 1994/95 to 2007/08" (August 2008). The current MFish research focus is documented in the report entitled "Freshwater Eels: Draft Medium Term Research Plan 2006-2009".

61 Previous and future research activity includes:

a) characterisation (species, sex, length, weight and age by catchment);

b) monitoring of the commercial eel fishery, including CPUE indices;

c) studies to better evaluate age and growth;

d) feasibility of developing eel stock assessment models;

e) evaluation of transfer techniques to enhance the resource;

f) eel population status surveys in local areas of importance to non-commercial interests;

g) monitoring the recruitment of juvenile eels;

h) assessing the adequacy of escapement of adult eels in spawning condition;

i) a GIS mapping project to deliver better estimates of expected biomass in lakes, rivers and streams; and

j) estimating the non-fishing mortality of eels as a result of other water resource users (e.g. drainage and drain clearance, fish passage restrictions, pollution, irrigation works, flood control pumping etc).

62 Research commissioned by MFish in the 2006-07 fishing year is outlined in the 'Services' section of this plan. Similarly, approved research projects for the 2007-08 and some deferred or scheduled to commence in the 2008-09 fishing year are noted.

Total allowable catch

63 There are four stocks of shortfin eel and four stocks of longfin eel in the North Island. The TAC for each of these stocks has been set under section 14 of the Act (see Table 1). Section 14 was used to set TACs instead of s 13 of the Act on the basis that, because of the biological characteristics of eel species, it was not considered feasible to calculate maximum sustainable yield at that time. The setting of North Island eel stocks under s 14 of the Act is in contrast with the earlier setting of TACs under s 13 of the Act for the six South Island and two Chatham Island eel stocks.

64 The Minister of Fisheries determined the high level management objective for the North Island eel fishery on its introduction into the QMS on 1 October 2004. In setting TACs under section 14 of the Fisheries Act 1996, the management objective is to improve the stock structure (ie, size composition) and abundance over the medium term (being 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.

65 MFish continues to refine management settings to ensure that the best possible outcomes consistent with the purpose of the Act are produced. To further ensure that the eel fishery is sustainably used, commercial fishers have been prohibited from taking or possessing eels above 4 kg on a nationwide basis since April 2007. Further, a review of catch limits applying to North Island eel stocks was conducted in mid-2007 in order to ensure that both

sustainability and utilisation outcomes were addressed with more certainty. The outcome from that review was to further reduce catch limits for the start of the 2007-08 fishing year.