On a pathway to extinction?

Commentary on the Parliamentary Commissioner for the Environment's report on longfin eels

27 June 2013

Executive Summary

The Parliamentary Commissioner for the Environment recently investigated the status and management of the longfin eel. Her report – *On a pathway to extinction?* – was released in April 2013. The Commissioner concludes that longfin eels have entered a downward spiral that will lead to their extinction. In order to halt this spiral, she recommends the suspension of commercial fishing for longfin eel, a stronger leadership role for the Department of Conservation, and an independent review of the underlying science.

This commentary analyses the conclusions reached by the Commissioner and the robustness of the information on which the conclusions have been based. The commentary seeks to follow the "chain of logic" linking the information relied upon by the Commissioner to her conclusions and recommendations. The main findings of this analysis are that:

- The Commissioner's investigation was informed by the best available information and there are no other significant sources of information that would have added substantially to her investigation;
- However, the Commissioner's analysis and interpretation of the available information was not based on a documented analytical framework and nor was it informed by a structured analytical process such as peer review or an expert panel;
- There is considerable evidence to support the proposition that the Commissioner favoured sources of information that backed up her conclusions and dismissed information that was equivocal or pointed to an alternative conclusion;
- The conclusions reached by the Commissioner – i.e., that the longfin eel population is declining towards extinction and that commercial fishing is the most significant contributor to this decline – differ from those that other reviewers have drawn from the same information;
- The report does not show a clear linkage between the information reviewed and the conclusions reached – it instead relies on general justifications such as the need to make an "overall judgement" and "the cumulative weight of scientific evidence", resulting in a set of conclusions and recommendations that are opinion-based rather than evidence-based;
- Of the report's three recommendations, only the last – i.e., a call for an independent review of the science – follows logically from the available information and conclusions; and
- A broadly-supported review of the available information could usefully form the basis of a future work programme to improve the status and management of the longfin eel.

1. Introduction

The Parliamentary Commissioner for the Environment Dr Jan Wright recently investigated the status and management of the longfin eel. She released her report – *On a pathway to extinction?* – on 17 April 2013.[1] The accompanying press release, headed *Stop commercial fishing or longfin eels will perish*, sums up the Commissioner's main conclusions and recommendation. In the press release, Dr Wright said she was "confident that the weight of evidence shows we need to act urgently to save this species."[2]

1.1 The Commissioner's findings

The Commissioner set out to assess "just how threatened the longfin eel is and to consider what actions might need to be taken to manage and protect it". She found that the once-plentiful longfin eel population has been depleted through a combination of historical causes including land use and water quality changes, extermination programmes, river barriers such as hydro dams and culverts, and commercial fishing. Her report is critical of the management of commercial eel fishing by the Ministry for Primary Industries (MPI) and the protection of longfin eels by the Department of Conservation (DOC). After reviewing a range of sources of information, Dr Wright concludes that longfin eels have entered a downward spiral that, in the absence of active intervention, will lead to their extinction.

The report makes three recommendations. The first is that commercial fishing should be suspended until longfin eel stocks are shown to have recovered. The second is that DOC should use policy mechanisms such as Freshwater Fisheries Management Plans to improve eel habitat and fish passage. Finally the Commissioner recommends a fully-independent expert peer review panel should be established to assess the full range of information available on the status of the longfin eel population.

1.2 Diverse reactions

Environmental groups responded to the Commissioner's report with enthusiasm, seeing it as a vindication of their campaign to ban commercial eel fishing.[3] The Greens, Labour and the Māori Party were also quick to state their support for a moratorium or rāhui on commercial fishing for longfin eel.[4]

Reaction in the scientific community was divided, with some scientists supporting the Commissioner's call to ban commercial fishing, while another observed that the Dr Wright's conclusions had been reached from "an unfair appraisal of peer reviewed research information" and that "long standing commissioned research is

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[1] Parliamentary Commissioner for the Environment, April 2013. *On a pathway to extinction? An investigation into the status and management of the longfin eel*

[2] Parliamentary Commissioner for the Environment press release, 17 April 2013 http://www.scoop.co.nz/stories/PO1304/S00199/stop-commercial-fishing-or-longfin-eels-will-perish.htm

[3] Forest and Bird press release, 18 April 2013 http://www.scoop.co.nz/stories/PO1304/S00213/pces-report-vindicates-campaign-to-save-native-eels.htm

[4] Press releases, 17 April 2013: Greens http://www.scoop.co.nz/stories/PA1304/S00322/longfin-eels-need-a-lifeline.htm; Labour http://www.scoop.co.nz/stories/PA1304/S00317/labour-welcomes-longfin-eel-report.htm; Maori Party http://www.scoop.co.nz/stories/PA1304/S00318/maori-party-calls-for-action-to-protect-long-finned-eels.htm

unreasonably picked apart in apparent favour of other research information that fits better with a preconceived view of a resource in decline".[5]

The commercial eel industry responded that "Dr Wright is taking the soft option by calling for the industry to be closed down, and instead should focus on improving the quality of the eel's habitat". The industry claimed longfin eel stocks are recovering, mainly due to the enhancement efforts of commercial and customary fishermen, and that "the report appears to ignore this."[6]

Amid these divergent views, the responsible agencies DOC and MPI announced that they were working together to review and respond to the recommendations. Meanwhile, in light of the seriousness of the Commissioner's conclusions and recommendations and the strong interest of Māori in all aspects of the eel fishery, Te Wai Māori Trust called for an urgent review of longfin eel information.[7]

1.3 Purpose and structure of the commentary

This commentary provides a contribution to the review process by analysing the conclusions reached by the Commissioner and the robustness of the information on which the conclusions have been based. The commentary is not a scientific review of the primary literature or the Commissioner's conclusions; instead it seeks to provide a "commonsense" analysis of the chain of logic linking the information relied upon by the Commissioner to her conclusions and recommendations.

Part Two of the commentary analyses the information used by the Commissioner, the conclusions reached and the recommendations made. Part Three contains some concluding comments on the robustness of the Commissioner's report.

An appendix provides a three-page summary of the report.

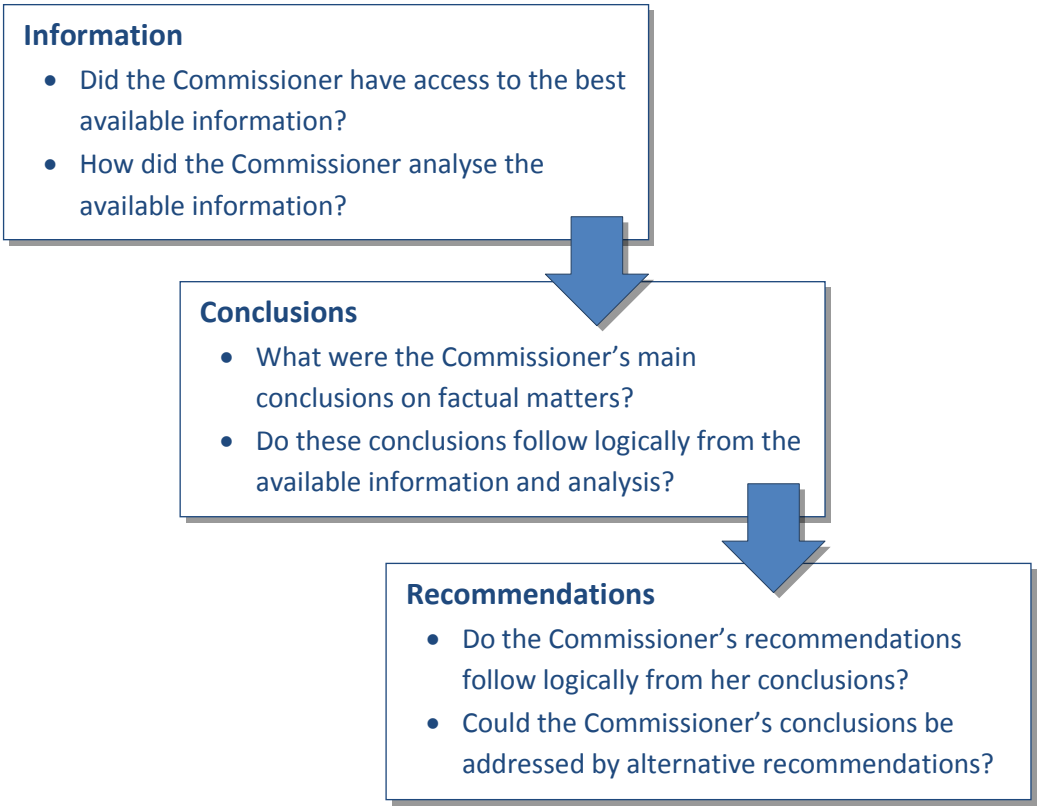
[5] Reactions from the scientific community collated by the Science Media Centre http://www.sciencemediacentre.co.nz/2013/04/17/pce-report-calls-for-moratorium-on-longfin-eel-fishing-experts-respond/

[6] Bill Chisholm, South Island Eel Association, in various press stories, April 2013

[7] Te Wai Maori Trust press release, 17 April 2013 http://www.scoop.co.nz/stories/PO1304/S00198/urgent-review-of-longfin-eel-information-needed.htm

2. Analysis

The analysis in this section of the commentary seeks to follow the rationale that links the information the Commissioner used to her conclusions and recommendations. This relationship and the key questions at each step are shown in the following diagram.



2.1 Information used by the Commissioner

2.1.1 Did the Commissioner have access to the best available information?

The Commissioner has drawn heavily on an overview of the status of longfin eels prepared by NIWA scientist Don Jellyman in early 2012 (the "NIWA overview").[8] Dr Jellyman is a freshwater fisheries scientist specialising in the biology of freshwater eels. He is the author or co-author of many of the reports that are summarised in the overview and is also a member of the Eel Working Group. His overview is therefore one of a deeply involved eel expert, rather than an independent observer (or a stock assessment scientist).[9]

The NIWA overview examines a number of indicators of stock well-being and draws some conclusions about each indicator. It also contains an overview of the status of longfin eels drawn from earlier and current research.

[8] NIWA (2012). The status of longfin eels in New Zealand – an overview of stocks and harvest. Prepared for the Parliamentary Commissioner for the Environment. January 2012. Authors/contributors: Don Jellyman

[9] This is simply an observation, and is not intended as a criticism of Dr Jellyman's work or the NIWA overview

The sources of information examined by NIWA include:

- Recruitment indices
    - Glass eel sampling by NIWA over a 12 year period;
    - A comparison of glass eel samples from the Waikato River taken in the 1970s and 2004/2005;
    - MPI annual collation of data on the number of elvers caught at hydro stations throughout New Zealand (four main sites and a number of supplementary sites);
    - Length distributions of juvenile eels from various catchments, as determined by NIWA using electric fishing surveys;
- Records on the New Zealand Freshwater Fish Database[10]
    - Electric fishing records;
- Catch per Unit Effort (CPUE)
    - Standardised CPUE for the South Island for the period 1990 – 2006;
    - Standardised CPUE for the North Island for 1990 – 2007;
- Size grades
    - Results of questionnaires sent to eel processors in 1979 and 1991;
    - A shed monitoring programme that ran from 1995/96 – 1998/99 and then recommenced in 2003/04 which provides information on trends in size grades of eels in processing sheds in the North Island and in Southland/Otago;
- Sex ratios
    - Data from fishery dependent surveys.

NIWA emphasises that it is important to review the data in its totality rather than on a piecemeal basis, and draws some general conclusions, which are somewhat contradictory, but perhaps best summed up here:[11]

> *Despite some uncertainty about the fishery trends, there is no doubt that the longfin resource is seriously depleted – whether stocks can cope with the impacts of historic and present levels of exploitation, compounded by issues of reduced access and the annual loss of spawning eels at hydro and pumping stations, is uncertain.*

The Commissioner has augmented NIWA's overview with more recent data from electric fishing surveys undertaken by Environment Waikato and the Otago Regional Council.

It therefore appears that the Commissioner had access to a wide range of sources of information. As far as I am aware, there are no other significant sources of information that would have added substantially to her investigation.[12] Notably, MPI's Eel Working Group has access to a similar range of information (with the exception of the regional council surveys) when assessing the status and trends of eel stocks.

[10] The Freshwater Fish Database is a repository for records of freshwater fish collected by a variety of methods and individuals

[11] NIWA overview, page 66

[12] Note that the Commissioner's report does not cover the implications of global weather patterns or climate change for eel distribution or abundance

2.1.2 How did the Commissioner analyse the available information?

The Commissioner's analysis of the available information can be evaluated in terms of the robustness of the:

- Analytical frameworks applied; and
- Analytical processes used (peer review, expert panels etc).

This evaluation is made more difficult by the fact that the Commissioner's report is written in a populist, non-scientific manner. Although this may make the report more accessible, it does not enable readers to easily assess the rigour of the underlying analysis.

The central question that the Commissioner seeks to address – i.e., the status and trend of the longfin eel population – is essentially a scientific question that is best answered by the application a clear and robust analytical process. Analytical frameworks and peer review processes for assessing the quality of information are well established, particularly in relation to fisheries management.

For example, MPI has a framework for ranking science information in order to provide a clear and objective indication of the quality of information used to inform fisheries management decisions.[13] The rankings are applied during the Stock Assessment Working Group process, in acknowledgement that decisions about the best available science do not reside with a single individual. 'High quality' information is defined as that which has been subjected to a rigorous science quality assurance and peer review process (as set out in MPI documentation) and substantially meets prescribed principles for science information quality – i.e., peer review, relevance, integrity, objectivity and reliability (each of which is defined in some detail).

DOC's New Zealand Threat Classification System (NZTCS) process is a further example of a structured, analytical approach to assessing species status and trends. The NZTCS process is built around expert judgment. Panels of appointed experts are required to consider the evidence for particular status and trend criteria and apply a documented decision-tree approach to reach their conclusions.[14]

In contrast, there is no evidence in the Commissioner's report of the application of an analytical framework or evidence-based expert judgment process for assessing the quality of information. Instead, the Commissioner's assessment of the quality of various information sources appears to be driven by unstated assumptions and preferences. This can be illustrated in five brief case studies of various sources of information available to the Commissioner.

1. ***Glass eel sampling***

   Glass eel sampling has been carried out by NIWA over a 12 year period, initially at 12 sites around New Zealand and later reduced to six sites. The NIWA overview notes that the sampling programme shows no evidence that recruitment of longfins has declined over this period. Although this is the longest time series of glass eel samples available in New Zealand, the Commissioner downplays the

[13] Research and Science Information Standard for New Zealand Fisheries. Ministry of Fisheries. April 2011

[14] Townsend et al (2008). New Zealand Threat Classification System Manual. Department of Conservation. January 2008. Note that the NZTCS process has been challenged by the seafood industry in terms of both the classification process and the substantive outcomes (i.e., the threat rankings assigned to certain species, including longfin eel)

value of this information, commenting that "there are few measurements of glass eels leaving the sea" and that "research has been intermittent and done over relatively short time periods".[15]

2. Sampling of elvers at hydro stations

Sampling of elvers at hydro stations has been undertaken by MPI since 1995, although sampling effort has varied over the years, creating some acknowledged issues with the quality of the data. Nevertheless, NIWA is sufficiently confident of the data to conclude in their overview that at two sites (Piripaua and Mararoa) there is evidence of an increase in elvers over time and at the remaining sites there is a strong trend to increased abundance over time although these relationships are not statistically significant.

In contrast, the Commissioner concludes that increases in elvers should not be read as a positive indicator of the status of longfins because of major limitations in the quality of the information. She says that "no firm conclusions can be drawn" and also comments that this information is "much less useful" than the information collected in electric fishing surveys (case study 4 below).[16]

3. CPUE

Standardised catch per unit effort (CPUE) data are used as an index of relative abundance by the Eel Working Group. According to the NIWA overview, South Island CPUE shows a decline until about 2000 and thereafter a general increase, whereas in the North Island there is strong evidence of declines in all statistical areas but with some flattening of these trends in recent years.

The Commissioner is dismissive of CPUE data, noting "serious limitations" including: catch is measured solely by weight and does not take account of the numbers of fish caught; effort is underestimated because of serial depletion and the absence of recorded effort when no eels are caught; and no information is recorded about small eels that escape from nets. She concludes that CPUE is of questionable value in assessing freshwater eel fisheries.[17]

4. Size distribution information from electric fishing surveys

NIWA has carried out electric fishing surveys on a range of waterways over the last 15 years and the samples have provided size distribution information for juvenile eels. According to the NIWA overview, this data shows clear evidence of a lack of juvenile longfins at sites in both islands, but more pronounced in the South Island. The Eel Working Group noted that these results were unexpected and has not accepted the data and analysis. However, the Commissioner comments favourably on the quality of the information, stating that "good data does exist on age structure".[18]

Electric fishing surveys were also undertaken recently by Environment Waikato (three years of survey data) and Otago Regional Council (six years of survey data). The surveys – which are

[15] NIWA overview, page 31 and PCE report, page 41
[16] NIWA overview, page 35 and PCE report, page 48
[17] NIWA overview, page 41 and PCE report, pages 47, 49 and 53
[18] NIWA overview, page 39 and PCE report pages 41 (re Eel Working Group) and 54. Bill Chisholm has also expressed serious doubts that repeated electric fishing surveys can provide accurate measures of juvenile eel populations. Chisholm says that "electric fishing is known to be less than 100% effective in catching eels" and cites Chisnall 1994 (Chisholm WP 2009. Letter to the Editor. New Zealand Freshwater Sciences Society Newsletter)

unpublished – are reported positively by the Commissioner, who notes that "not only do these surveys yield the most up-to-date information available on the population structure in longfins, they were done using the latest approved protocols".[19] In contrast to the Commissioner's critical assessment of CPUE data, the body of the report is silent on the limitations of electric fishing methodologies. An endnote dismisses the Eel Working Group's concerns about the methodology (the Group proposed that longfin elvers may burrow deep into the stream bed and therefore not be stunned by the electric current) with the comment that "there is no evidence for this theory".[20]

5. Biomass estimates

The NIWA overview summarises modelling undertaken by Graynoth (2008) to estimate spawner escapement and the current and virgin biomass of longfin eels. According to NIWA, Graynoth estimated that:[21]

- virgin biomass was twice the current estimated biomass of 12,200 tonnes; and
- approximately 49% of total tonnage of longfin is either in reserves or areas that are rarely fished.

The Commissioner's report does not mention Graynoth's biomass estimates. She claims that about 7% of the national stock of longfin eels is in waters where commercial fishing is not allowed and migrating females are not blocked by hydro dams from escaping out to sea (although this estimate is expanded somewhat in an endnote).[22]

It is not the intention of this commentary to judge the quality of the various sources of information available to the Commissioner or to draw any conclusions about the respective merits and limitations of, for example, CPUE data versus electric fishing data. However, from the case studies above it is possible to reach some conclusions about the Commissioner's approach to assessing the quality of various sources of information. The case studies demonstrate that the Commissioner has:

- Selectively used the available information summarised by NIWA, and selectively used conclusions from individual papers such as Graynoth (2008);
- Placed a low weight on information sources that form New Zealand's longest time series of data on longfin eels and which have been through an established, transparent peer review process in the Eel Working Group;
- Placed a relatively high weight on short-term surveys that have not been published and have not been through a transparent peer review process; and
- Investigated and highlighted the shortcomings of some sources of information (e.g., CPUE) but downplayed the limitations of other sources of information (e.g., electric fishing).

[19] PCE report, page 50
[20] PCE report, endnote 131. The same endnote records and responds to MPI's concerns that the data is unreliable because it comes from multiple sites and may not capture small size classes of longfin eels
[21] NIWA overview, page 63
[22] PCE report, page 31

There is therefore considerable evidence in support of the proposition that the Commissioner has responded favourably to information that supports her conclusion that longfin eels are "in trouble" and dismissively to information that is equivocal or points to an alternative conclusion.

2.2 The Commissioner's conclusions

2.2.1 What conclusions does the Commissioner reach?

The self-stated purpose of the Commissioner's report is "to assess just how threatened the longfin eel is and to consider what actions might need to be taken in order to manage and protect this important species". In order to achieve this purpose, clear factual conclusions are required on two matters, i.e.:

- the population status and population trend for longfin eels; and
- the current threats to the population.

The accompanying press release states that "Dr Wright's report on the status of the species… shows the longfin eel is on a slow path to extinction" and "stopping [commercial fishing] is the only action that has immediate potential to reverse the decline of this extraordinary creature". From this it might seem that the Commissioner reached clear conclusions on the two matters – i.e., that the longfin eel population is declining towards extinction and that commercial fishing is the main cause of this decline. However, in the report itself the factual conclusions are far from clear.

In relation to the status of the eel population, text in the body of the report asserts that the species is "in trouble" but is tentative in relation to the risk of extinction:

> *When all of this information is considered as a whole it points clearly to a species that is in trouble. Individual longfins live so long it would take many decades for the species to vanish. The evidence today shows that the species **may have** entered a downward spiral that **could lead to** such an extinction.*

By the end of the report, without any additional information being considered, the conclusion has strengthened:[23]

> *The weight of the scientific evidence summarised in this report is strong. Without much more active intervention, the longfin fishery **will steadily shrink** and the largest freshwater eel in the world **will continue its slow path to extinction.***

The use of vague and unscientific terms such as "in trouble" is not helpful – for instance does this mean the population is depleted or declining or both?

The conclusion that longfin eel stocks are depleted in comparison to their pre 1930s levels is beyond debate. However, the Commissioner does not draw any conclusions on exactly how depleted the stock is, even though information is available on which some more definitive conclusions about the status of the longfin eel population could be drawn. As noted above, the Commissioner chose not to mention Graynoth's (2008) estimate that the stock is at around 50% of virgin biomass, although she does refer to Graynoth's estimate that the biomass of breeding longfins is less than 20% of 1930s levels. She notes that "there will be limits

[23] First extract from page 50, second extract from page 67, emphasis added.

beyond which population collapse is inevitable" but – in spite of some speculation and suggestion[24] – does not draw any conclusions about whether the longfin eel population has been depleted to a level at which extinction is inevitable.

Stock status and stock trend are frequently (and unhelpfully) conflated in the report but the Commissioner's conclusion is that the stock is continuing to decline – the population trend is variously described as being in a downward spiral, steadily shrinking, declining in resilience, and undermining the future of the species.

In relation to the main threats, the report identifies three current "downward pressures" on eel populations – ongoing loss of habitat, the blocking of fish passage by barriers in rivers, and fishing. Several times the Commissioner emphasises that commercial fishing is "far from the only reason for their decline".[25] Nevertheless, her ultimate conclusion is that "commercial catch is significant and is contributing to the decline of this species" and "placing a moratorium on the commercial harvest is the only way to make a difference reasonably quickly".[26]

2.2.2 Do the conclusions follow logically from the available information and analysis?

The Commissioner acknowledges that none of the sources of information about longfins is perfect and a degree of uncertainty will always remain. She goes on to say that judgments need to be made on the weight of evidence after considering all the available information.[27] Using these very reasonable statements as a starting point, three questions form the basis of the analysis in this section of the commentary:

- How certain is the Commissioner about her conclusions?
- Of all the available information, which evidence has been given the greatest weight in reaching the conclusions?
- Have other parties reached alternative conclusions based on similar information?

The two main conclusions are addressed in turn.

<u>The conclusion that the longfin eel is "on the slow path to extinction"</u>

Despite the uncertainty in the information, the Commissioner is firm in her conclusions about the status and population trends of the longfin eel, stating that:[28]

- *when all of this information is considered as a whole* ***it points clearly*** *to a species that is in trouble*;
- ***the weight of the scientific evidence*** *summarised in this report* ***is strong.***

The Commissioner therefore expresses certainty about her conclusions, even though the conclusions as to stock status and trend are in themselves worded imprecisely.

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[24] *It is very difficult to predict* ***just how low the numbers of elvers and breeding females can fall*** *before the population of longfins becomes unsustainable* (PCE report page, 46); *… it will be many decades before they are biologically extinct because they live so long. But* ***they could well be in danger of 'functional extinction'*** (PCE report, page 81, emphasis added)

[25] PCE report, Commissioner's overview

[26] PCE report, page 69

[27] PCE report, page 39

[28] PCE report, pages 50 and 67, emphasis added

The report contains insufficient detail to enable the reader to follow the chain of reasoning between the information reviewed and the final conclusion – it relies instead on an "overall judgment" and the "cumulative weight of the scientific evidence". However, as noted above, the Commissioner has assigned different weights to various sources of information and this has influenced her conclusion about stock status and trends. In particular, the electric fishing surveys undertaken by NIWA and the two regional councils undoubtedly have had a greater influence on her conclusions than MPI's long time series of CPUE data and glass eel monitoring. It is also possible that the clear historical evidence of population decline may have assumed a greater weight than current indicators which provide a more complicated picture of stock trends. Significantly, there is nothing in the report that directly justifies the bold conclusion that, in the absence of urgent intervention, the species will head towards extinction.

Other parties have reached different conclusions from similar information, as summarised below. Notably, two of these parties (DOC and the Eel Working Group) have reached their conclusions following a structured assessment process involving peer review and the application of a documented analytical framework.

DOC has used the NZTCS to classify longfin eels as *at risk/declining*. To place this in context, the NZTCS has four main threat categories – extinct, threatened, at risk and not threatened. Subcategories provide further information. For instance 'nationally critical' and 'nationally vulnerable' are subcategories of 'threatened'. Species – such as longfin eel – in the 'at risk' category do not meet the criteria for any of the 'threatened' categories. However, they may be declining (though buffered by a large total population size and/or a slow decline rate). DOC notes that if a declining trend continues, a species may eventually be listed as 'threatened' in future.[29]

The NIWA overview concludes that "there is no doubt that the longfin resource is seriously depleted" but that there is uncertainty about some of the fishery trends and an absence of unequivocal evidence of stock depletion and damage. It also states that "biological extinction seems unlikely for such a widespread and persistent species, partly because as densities reduce, exploitation becomes less cost effective".[30]

The Eel Working Group notes that estimates of current biomass for eel stocks are not available and that CPUE data provide the only estimates of relative abundance. The Working Group describes a recent longfin population model which estimates current female spawning stock biomass to be approximately 55% of pre-exploitation levels.[31] In contrast to previous years, the Group currently expresses no specific concerns about the status of the stock and draws no conclusions about population trends.[32]

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[29] NZTCS classifications were undertaken in 2008-2011. Classifications for aquatic species are currently under review. For classification methodology, see Townsend et al (2008). New Zealand Threat Classification System Manual. Department of Conservation. January 2008

[30] NIWA overview, page 66. Dr Jellyman observes that his conclusions on extinction assume that there is targeted fishing for longfin eel.

[31] The model is Fu *et al* (2012). The Working Group observes that further analysis is required to investigate the underlying assumptions of the model. Report from the Fisheries Assessment Plenary, May 2012. Stock assessment and yield estimates. Compiled by Ministry for Primary Industries Fisheries Science Group, May 2012

[32] In earlier Working Group reports (recorded in the NIWA overview) the Group expressed concern that "there is a high risk that the current exploitation levels for longfin eels in particular, coupled with past and present anthropogenic impacts, are not sustainable". In response to these and similar earlier expressions of concern, three areas were closed to commercial fishing in 2005 (the Mohaka and Motu Rivers and much of the Whanganui River), and in 2007 significant TACC cuts were made to all North Island longfin eel stocks and a 4kg maximum size limit was introduced in the North Island and Chatham Islands (to match existing regulations in the South Island)

Finally, Bill Chisholm, spokesperson for the South Island Eel Industry Association, states that "scientific data clearly demonstrates that longfin eels have been increasing over the last decade",[33] basing his conclusion on South Island CPUE data and juvenile eel sampling at hydro dams.[34]

The conclusion that commercial fishing is contributing to the decline of longfin eel

The Commissioner also ascribes great certainty to her conclusion about the role of commercial fishing in relation to species decline, stating that:[35]

- ***what is clear*** *is that the commercial catch* ***is significant and is contributing to the decline*** *of the species*; and
- *placing a moratorium on the commercial harvest is the* ***only way to make a difference*** *reasonably quickly.*

As with the conclusion on stock status and trends, the report contains insufficient detail to enable the reader to follow the chain of reasoning between the information reviewed and the final conclusion on the factors that are contributing to species decline. It appears that the Commissioner has reached her conclusion without undertaking any structured quantitative or qualitative risk assessment of relative threats to the longfin population. Additional information was available in the NIWA overview that could have been used in a structured risk assessment. For example:[36]

- Graynoth (2008) estimated that annual commercial harvest rates are about 3.3% in waters open to commercial fishing or 1.6% over all waters. NIWA observes that these are modest harvest rates compared to many marine fisheries which have harvest rates of 10% or greater (while also noting that species such as eels must be harvested conservatively); and
- the NIWA overview provides an estimate, at the Commissioner's request, that total hydro mortality may be up to 30% of the total commercial longfin catch.

Neither of these estimates is used in the Commissioner's report. The Commissioner also deliberately excludes from her consideration sources of risk to the longfin eel population that cannot be controlled, including: [37]

- variations in ocean currents due to global weather systems that affect the numbers of eel larvae reaching the coast of New Zealand; and
- effects of climate change on eels in freshwater ecosystems.

It would seem from the report's concluding chapter that the dual rationale for focusing on commercial fishing is that first, commercial fishing is the only source of eel mortality for which accurate data exists and second, commercial fishing is able to be controlled. Somewhat ironically then, the conclusion about longfin eel population risk from commercial fishing activity is strongly influenced by availability of good data and an effective management regime.

[33] Press release, 17 April 2013
[34] Vic Thompson, pers comm, 27 May 2013
[35] PCE report, page 69, emphasis added
[36] NIWA overview, pages 63 and 27
[37] PCE report, page 17

The Commissioner cites no evidence to support the conclusion that banning commercial fishing will "make a difference reasonably quickly". On the contrary, one of the general themes of the report is the long time lag between actions and population responses.

Other parties have reviewed the information available to the Commissioner and have drawn more limited or different conclusions. The NIWA overview states that "whether stocks can cope with the impacts of historic and present levels of exploitation, compounded by [other factors], is uncertain".[38] Although Dr Jellyman suggests that longfin eels are being fished at an "unsuitable level", the NIWA overview stops short of concluding that current commercial fishing levels are unsustainable.[39] The Eel Working Group does not draw any conclusions on whether current levels of commercial harvest are sustainable and, therefore, is silent on whether commercial fishing is contributing to the purported population decline.[40] Bill Chisholm has proposed that:[41]

> *the decline in longfin eel populations over the last 40 years is likely to have been caused by exclusion from their habitat by hydro dams. Add the massive disruption of their habitat through land development and water abstraction, and the real threats to longfin eels start to clarify. The commercial eel fishery has correspondingly reduced as a result of these impacts, but to blame commercial fishing as a principal agent of decline is to misidentify the real threats to the fishery.*

Chisholm's proposition is based primarily on estimates in Graynoth (2008) that 49 percent of longfin eel stocks are in reserves or in small streams that are unlikely to be fished. He poses the question: *So, if nearly half the waterways are unfished, what then caused the massive decline in longfin eel populations…?*

In summary, it is difficult to reconcile the diverse and uncertain information available to the Commissioner on longfin eel population status, trends, and threats with her unequivocal conclusions on these matters – particularly as others have reached different conclusions from the same information.

2.3 The Commissioner's recommendations

The Commissioner's report contains three main recommendations, each of which is evaluated below based on the following questions:

- What does the recommendation entail?
- Does the recommendation flow logically from the information and conclusions?
- Could alternative recommendations more effectively address the Commissioner's conclusions?

2.3.1. Prohibiting commercial fishing

The Commissioner's first recommendation is that ***the Minister for Primary Industries should suspend the commercial catch of longfin eels until longfin eel stocks are shown to have recovered***. As a prerequisite, she recommends that the South Island eel stocks should be split into separate longfin and shortfin stocks. Some of the practical matters to consider when implementing a ban on commercial fishing are considered below.

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[38] NIWA overview, page 66
[39] NIWA overview, page 65
[40] Report from the Fisheries Assessment Plenary, May 2012. Stock assessment and yield estimates. Compiled by Ministry for Primary Industries Fisheries Science Group, May 2012
[41] Chisholm WP 2009. Letter to the Editor. New Zealand Freshwater Sciences Society Newsletter

a) The mechanism for suspending longfin catch: The Minister would have to either reduce the TACCs for all longfin stocks to zero or alternatively, use regulations to effectively prohibit commercial fishing for longfins (e.g., by closing areas). A regulatory closure would avoid the need to first split South Island eels into two species.

b) Legal considerations: In order to lawfully employ either of the above mechanisms, the Minister would need to be satisfied that the decision is consistent with the purpose of the Fisheries Act (providing for utilisation while ensuring sustainability) and is supported by the best available information. If the fishery were to be closed in the absence of any demonstrated sustainability risk, eel quota owners may have an arguable case for compensation for unjustified taking of property.

c) Stock recovery: It is not clear what is meant by "until longfin eel stocks are shown to have recovered" – i.e., recovered to what level, who decides, and how is recovery measured? Ideally a decision rule would be established, based on fishery-independent data, but this could be problematic as the only current estimates of relative abundance are based on CPUE.

d) Implications for research and stock enhancement: Banning commercial fishing would remove an important source of funding for stock assessment, as well as disrupting the only available index of relative abundance (CPUE data). It would also limit the resources available for stock enhancement under industry-run elver transfer programmes.

e) Effort shift: Commercial fishing effort may shift to shortfin eels, placing additional pressure on this species. Harvest levels are constrained primarily by the economics of the fishery rather than by the TACCs so the "headroom" within the TACCs allows effort shifts to occur even if longfin and shortfin eel stocks are separated (as is the case in the North Island).

f) Non-commercial catch: In her overview, the Commissioner hopes that "some means can also be found to reduce customary and recreational catches, should they be significant", but this expectation is not reflected in her recommendations. Banning commercial fishing in the absence of a full understanding of the nature and scale of non-commercial catch would be a legally risky course for decision makers, and – if non-commercial catch is significant – may not be sufficient to ensure sustainability.

The recommendation to suspend commercial fishing flows directly from the Commissioner's conclusions that:

- the longfin eel population is declining;
- commercial fishing is the most significant cause of ongoing population decline; and
- stopping commercial fishing is "the only way to make a difference reasonably quickly".

As discussed above, none of these conclusions is justified by the evidence presented in the report.

The subsidiary recommendation to split the South Island eel stocks into two species is also unsupported by the available information. When South Island eels were introduced into the QMS, no information existed on which to set separate TACCs for longfins and shortfins, so the two species were introduced as a single stock with separate reporting. Catch reporting since QMS introduction has now provided information that could be used to split the species into separate stocks. However, with CPUE for South Island longfin eels stable or

increasing across all QMAs, and with the industry applying voluntary measures on a species basis, it is difficult to support the conclusion that the combined stock is preventing effective management.

Alternative recommendations could be equally (if not more) effective in addressing the Commissioner's conclusion that commercial fishing is having a significant impact on the longfin population. Effective management of eel fisheries is reliant not so much on the overall level of removals from the stock, as on achieving adequate spawner escapement. To that end the Commissioner could usefully have recommended a "spatial review" to obtain accurate information on the areas in which spawning eels are protected and able to migrate to the sea, and to assess whether the biomass of eels in these areas is adequate to sustain the population. When overlaid with fine-scale catch information (commercial and non-commercial) a spatial management review could also provide a basis for balancing management of local depletion against stock-wide sustainability considerations.

Other possible measures that could have been considered in the recommendations are:

- Collection of accurate information on recreational and customary catch (quantities and location);
- Review of eel size limits and potential application to all types of harvest; and
- Support for and extension of current industry voluntary management measures (e.g., no capture of migrating eels, increased escapement tubes, negotiated land access rights to enable conservative rotational harvesting, ACE shelving etc).

2.3.2 DOC policy tools

The Commissioner recommends that ***the Minister of Conservation should direct his officials to use the policy mechanisms available to them to increase the protection for longfin eels and other threatened migratory fish.*** She proposes that DOC should display more leadership in the protection of longfin eels and, in particular, should:

- Prepare a Freshwater Fisheries Management Plan (FFMP) to provide guidance on the design of culverts and other barriers for eel passage as well as on activities such as drain clearance and water pumping, and to clarify the relationship between the Freshwater Fisheries Regulations and the Resource Management Act (RMA); and
- Ensure that longfin eels are not fished on the conservation estate.

FFMPs are prepared under sections 17J and 17K of the Conservation Act for the purpose of implementing general policies and establishing detailed objectives for the management of freshwater fisheries. A draft plan is prepared by DOC in consultation with specified parties and then formally notified. Submissions are called for, a hearing is held, the plan is revised, comments are provided by the Conservation Authority, the plan may be amended again and the Minister may then approve it or send it back for further revision. Given this onerous process, it is not surprising that DOC has never attempted to prepare a FFMP.[42]

Ensuring that longfin eels are not harvested on the conservation estate entails the Department issuing no more concessions for commercial eel harvest on any conservation land. DOC policy on assessing concession

[42] Similarly, DOC's efforts to prepare Population Management Plans for marine mammals using an almost identical process under the Marine Mammals Protection Act have been unsuccessful

applications is set out in Conservation Management Strategies which are prepared at conservancy (i.e., regional) level. A blanket prohibition on commercial eel fishing on conservation land would therefore need to be reflected through the inclusion of appropriate policies in all relevant Conservation Management Strategies.[43] The new policy framework would need to be legally justifiable under the Conservation Act and other conservation legislation that applies to the lands in question.

The Commissioner's conclusions on the protection of eel habitat and fish passage were that there was very little consistency in the rules governing eel habitat and fish passage in council plans or in conditions placed on resource consents, and that DOC had abdicated responsibility when it came to ensuring that eel harvest does not affect biodiversity on its own lands.[44]

Although the Commissioner's recommendations follow logically from these conclusions, in contrast to her recommendations on commercial fishing the recommendations on eel habitat and fish passage are surprisingly weak. Stronger recommendations could have been justified on the basis of information presented in the report. The following observations demonstrate the relative weakness of the recommendations on protecting eel habitat and fish passage:

- the recommendations prescribe "procedural fixes" – i.e., preparing a planning document – rather than substantive fixes (e.g., specific compulsory measures to improve the passage of migrating eels across hydro dams);
- a FFMP is a weak instrument for providing leadership in the protection of eels as it has direct effect only on DOC and Fish and Game Councils. Decision makers under other legislation are required only to have regard to a FFMP and provisions in other legislation take precedence over FFMP provisions;[45]
- DOC has failed to enforce the Freshwater Fisheries Regulations (including the requirement for the Director General to give written permission for culverts that could impede fish passage) but the Commissioner does not recommend that these existing regulatory requirements – which are far stronger and have more direct effect than provisions in a FFMP – should be enforced; and
- jurisdictional confusion between DOC and MPI over freshwater fisheries is hinted at, but not explored or analysed.[46] Thus, a potentially significant contributor to departmental inaction (i.e., lack of clarity in the legislative framework) is not addressed in the report.

The Commissioner's focus in her recommendations on DOC's "leadership role" in the protection of eels means that she overlooks the important role of the Ministry for the Environment (MFE) and regional councils under the RMA. Councils make the vast majority of decisions that affect eel habitat and eel passage, from routine activities such as drain clearance and culvert installation, through to rules controlling land use changes and the consenting of large projects such as hydro dams. The national framework for council planning and decision making under the RMA is the responsibility of MFE rather than DOC.

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[43] The Conservation Management Strategies for some regions already reflect a "no commercial eeling" policy

[44] PCE report, page 59

[45] See Conservation Act s17N, Fisheries Act section 11 (2)(b), and equivalent provisions in the RMA

[46] *Some roles are shared and the boundaries between jurisdictions and responsibilities are unclear* (PCE report, page 38); and *between 2004 and 2011 DOC and MPI undertook a jurisdictional review of their respective roles and responsibilities… unfortunately the review largely ignored eels because DOC regarded that 'their jurisdiction is relatively clear' – eels being 'a quota species under the Fisheries Act'* (PCE report, page 87)

The most obvious alternative recommendation to address the Commissioner's conclusions on eel passage and eel habitat is therefore for MFE to use existing RMA national instruments – such as a National Policy Statement or National Environmental Standard – to give greater direction to councils and achieve consistent protection of eel habitat and fish passage. The Commissioner notes the potential of upcoming changes to the RMA (proposed to be introduced later in 2013), but ignores the suite of national tools that are currently available to central government to achieve desired outcomes under the RMA.

2.3.3 Independent peer review of information

The Commissioner notes that her conclusions about the status of longfin eels differ from those reached by MPI. She therefore recommends that ***the Minister for Primary Industries should direct his officials to establish a fully independent expert peer review panel to assess the full range of information available on the status of the longfin eel population,*** and suggests that the review should include at least one international freshwater eel scientist. Implementation matters to consider include:

- who should be involved in the review and how should it be undertaken? In particular, what is the appropriate balance between the "true independence" desired by the Commissioner, and the inclusiveness necessary for all those with an interest in longfin eels to have confidence in the outcomes of the review?; and
- the relationship between independent peer review and the ongoing role and responsibilities of the Eel Working Group.

It is correct that information about the population status of longfin eels is characterised by uncertainty and conflicting views (which the Commissioner's report has done nothing to alleviate), so the general conclusion that the available information should be peer reviewed is sensible and reasonable. Logically, this should have been the first conclusion in the report, with the other recommendations subject to the findings of any review.

Although the Commissioner's recommendation on reviewing the available information may be justified, her reasoning for requesting a review is not so sound. The recommendation is based on two conclusions – first, that the information relied upon by MPI is "entrenched and narrow", and second that MPI has placed too much reliance on the Eel Working Group.[47] The information question has been explored earlier in this commentary.

The Commissioner suggests that the Eel Working Group is not independent and that MPI should not place so much reliance on its conclusions. This is a significant criticism, as it applies by extension to all MPI Working Groups. It is also notable that the structured and inclusive Stock Assessment Working Group process could not be more different from the review of scientific information undertaken by the Commissioner. The Commissioner does not explain why MPI should rely less on the Working Group advice – it can't be related to the robustness, transparency and openness of the process, so the obvious inference is that she simply does not agree with the conclusions the Working Group has reached.

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[47] *It is also encouraging that MPI has commissioned an independent review of the status of longfin eels. However, it appears that MPI will rely on the Eel Working Group to review this study* (PCE report, page 54); *…it appears that there is* ***a high level of reliance*** *placed upon the Eel Working Group as part of this decision-making process. In the case of longfin eels, MPI's own guidance on good science practice points to the need for* ***a wider and truly independent review*** (PCE report, page 66, emphasis added)

3. Conclusions of the commentary

The Commissioner's investigation has been informed by the "best available information". She has had access to a wide range of information, including original sources and a NIWA summary. There are no other significant sources of information that would have added substantially to her investigation.

The conclusion that longfin eels are on a downward spiral to extinction lies at the heart of the Commissioner's report. This conclusion rests on an interpretation of the available information that is not informed by any analytical framework or formal scientific process. In the absence of any documented framework for evaluating the quality of information, there is considerable evidence to support a proposition that the Commissioner has favoured information that backs up her conclusion and dismissed information that supports an alternative conclusion. For example, the report makes selective use of the available information, places a low weight on information from the longest time series of peer-reviewed data on longfin eels, emphasises unpublished short-term surveys that have not been subject a transparent peer review process, and selectively highlights the shortcomings of unfavoured sources of information (e.g., CPUE) while downplaying the limitations of other sources of information (e.g., electric fishing).

The Commissioner has thus approached a complex scientific question in a manner that does not demonstrate any scientific method. It is not surprising that the conclusions that she reaches differ from those that other reviewers have reached, working from the same information but using a more structured scientific framework and process.

Although the available information on longfin population status and threats has a high level of uncertainty, the Commissioner reaches firm conclusions. Unfortunately the report contains insufficient detail to enable the reader to follow the chain of reasoning between the information reviewed and the conclusions reached. It relies instead on general justifications such as the need to make an "overall judgment" and the "cumulative weight of the scientific evidence". The reliance on generalities and the lack of clearly presented rationale leaves the Commissioner open to the allegation that she has substituted opinion for an evidence-based approach in reaching her conclusions.

While some of the Commissioner's recommendations follow logically from her conclusions, the conclusions themselves are not supported by the available information. The recommendations as a package lack logic and balance. In particular, the third recommendation (to conduct an independent review of the available information) should logically be undertaken first, with the remaining recommendations subject to the outcomes of that review. The lack of balance is illustrated by the contrast between the strong, active recommendation on commercial fishing (prohibit it!), and the passive recommendations on other potential threats to the eel population (prepare a freshwater fisheries management plan).

The report adopts a populist, non-scientific style, rife with emotive language reflecting the "plight of the longfin eel". Although this may make the report more accessible, it comes at the expense of precision and clear direction. For instance, the use of vague and unscientific terminology such as "in trouble" disguises any real conclusions that the Commissioner may have reached on the population status of the longfin eel. The imprecise language and lack of analytical content in the report also hampers readers in assessing the robustness of the underlying analysis and ultimately undermines its contribution to ensuring a sustainable future for the longfin eel.

Appendix
Summary of the Commissioner's report

The sustainability of the longfin eel fishery and the potential risk of extinction have been the subject of concern for many Māori, environmental groups, scientists and others. The Department of Conservation (DOC) has classified the threat status of longfin eel as "*at risk/declining*" and a petition calling for a moratorium on commercial fishing of longfin eels was recently presented to Parliament. In response to this increasing level of public concern, the report aims to assess just how threatened the longfin eel is and to consider what actions might need to be taken to manage and protect it.

Longfin eels are found only in New Zealand. They are one of the largest freshwater eels in the world and are our top native freshwater predator. They begin their lives in the tropical Pacific Ocean, where the fertilized eggs hatch and drift on ocean currents to New Zealand. Close to land, the larvae develop into transparent glass eels and swim into river mouths. In summer the elvers swim upstream, taking several years to reach a suitable habitat. Female longfin eels mature at around 40 years (males at 25 years) and can live for over a century. When the eels are ready to breed they undergo a number of physical changes before heading down river and out to sea. These "silver eels" spend about six months travelling back through the Pacific, where they spawn and die.

Historical relationship with eels

For Māori, eels are a taonga – a very important food source with special traditions related to their harvest and revered as a link to the gods. There is no evidence that pre-European Māori had any large impacts on eel populations but recently many Māori have expressed distress at the decline in local populations of eels.

Unlike shortfin eels which thrive in muddy-bottomed environments, the favoured habitat of longfin eels is clear flowing streams with shaded stony beds. Once plentiful throughout New Zealand's rivers, lakes and streams, the longfin eel population has been severely depleted through a combination of causes. Extensive deforestation and other land use and water quality changes have reduced the amount of suitable eel habitat. Hydro dams and river barriers such as culverts have effectively closed off about a third of the country's rivers and lakes to longfin eels. During the first half of the twentieth century eels were considered to be pests and were subject to extermination campaigns that continued through to the 1960s. At about this time a commercial eeling industry became established. Annual eel harvests grew to a peak of over 2,000 tonnes in 1972 and at one time there were 23 processing factories (now there are four).

In the North Island the commercial catch of longfin eels has fallen over the last decade but increased in recent years to 81 tonnes in 2011/12. In the South Island, catch has been variable but in 2011/12 156 tonnes were harvested – higher than any year in the last decade.

Current status of the longfin eel

Assessing the population status of longfin eels is particularly difficult because of their unusual lifecycle, and a degree of uncertainty will always remain. Various sources of information can be used to assess the state of the longfin eel population. For example, information on population age structure obtained from electric fishing surveys reveals a striking absence of very small longfin eels and a lack of large adult females.

Information on eel distribution from the Freshwater Fish Database shows that the probability of finding longfins in their natural habitat has fallen dramatically in the last 30 years. Fisheries managers use catch per unit effort (CPUE) data to provide an index of relative abundance. In the North Island, CPUE for longfin eels shows a decreasing trend between 1991 and 2007, whereas CPUE in the South Island has been more stable. The Ministry for Primary Industries (MPI) monitors elvers caught at hydro dams as a measure of young eels recruiting into the population, but this information is unreliable due to inconsistent sampling effort. Another potential source of information is the number of migrating mature longfins – these have never been counted in New Zealand, but are estimated to have fallen to about 20% of 1930s levels.

Individual longfins live so long that it would take many decades for the species to vanish, but when all the information is considered as a whole, the evidence shows that it may have entered a downward spiral that could lead to extinction.

Performance of management agencies

MPI has responsibility for managing the fishing of eels under the Fisheries Act 1996. South Island eels entered the Quota Management System in 2000, followed by the Chatham Islands in 2003 and the North Island in 2004.

There are three main areas of concern with MPI's management of the harvest of longfin eels. First, MPI's scientific assessment of the longfin eel population relies heavily on three indicators – CPUE, elvers arriving at hydro dams, and mature eels reaching the sea – each of which is inadequate. MPI has not used other available data which provides a richer understanding of the plight of the longfin eel. MPI also relies heavily on the Eel Working Group to review scientific information, but would benefit from an independent expert peer-review panel. The second concern is the absence of specified management targets for the eel fishery and the third is the management of South Island longfin and shortfin eels as a single stock with a combined catch limit.

DOC is responsible for protecting indigenous freshwater fisheries and freshwater fish habitats under the Conservation Act 1987. Commercial fishing is effectively prohibited in national parks and reserves (about 40% of the conservation estate), but may be allowed on other categories of conservation land if a concession is obtained. DOC's decisions on concessions are inconsistent and the biodiversity impacts of eel harvesting are not dealt with adequately. DOC is also responsible for the Freshwater Fisheries Regulations. These regulations require written permission for any structures that block fish passage (e.g., culverts), but have not been enforced. DOC could also prepare a Freshwater Fisheries Management Plan under the Conservation Act, but has yet to do so.

Outside the conservation estate, DOC has largely left responsibility for protecting eels to councils. Councils are responsible under the Resource Management Act 1991 for approving many of the activities that affect the habitat and passage of eels, from routine activities such as drain clearance and culvert installation, to large hydro dams and changing land uses. There is considerable variation in the ways that different regional councils deal with protecting freshwater fish habitat and passage in their resource management plans and resource consent decisions.

Conclusions and recommendations

Without much more active intervention the longfin eel will continue on its slow path to extinction. The current position has been many years in the making and it will take the combined efforts of central and local government, iwi groups and individuals to set the longfin eels on a more sustainable path.

The evidence shows that the number of very small longfins has become alarmingly low, and that where there are no young eels, there is also a lack of mature eels. Little is known about levels of recreational and customary catch, but it is clear that commercial catch is significant and is contributing to the decline of longfin eels. The first recommendation is therefore that **the Minister for Primary Industries suspends the commercial catch of longfin eels until longfin eel stocks are shown to have recovered**.

Changes to land use and barriers to fish passage are another cause of decline of longfin eels. DOC is well positioned to take a leadership role because of its responsibilities under the Biodiversity Strategy and its ability to prepare a Freshwater Fisheries Management Plan to provide guidance to councils and others. DOC also needs to lead by example and not allow the fishing of longfin eels on the conservation estate. The second recommendation is that **the Minister of Conservation directs his officials to use the policy mechanisms available to them to increase the protection for longfin eels and other threatened migratory fish.**

Although New Zealand's Quota Management System is impressive, MPI has developed an entrenched and narrow selection of scientific information on the status of the longfin eel population. The third recommendation is that **the Minister for Primary Industries directs his officials to establish a fully-independent expert peer review panel to assess the full range of information available on the status of the longfin eel population.**