Exploitation of freshwater eels in National Parks

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1. Background

The longfinned eel *(Anguilla dieffenbachii)* is endemic to New Zealand and is our most commonly encountered freshwater fish (Minns 1990). It is ubiquitous, found in virtually all freshwater habitats with access to the sea, from estuaries and coastal lakes, rivers, to high country lakes. Together with the shortfin eel *(A. australis)* it constitutes important traditional and commercial fisheries - a recent estimate of the total revenue generated by commercial eel fishing was $36 million (Te Waka a Maui me ona Toka Mahi Tuna 1996).

Catches of eels peaked at 2400 t in 1975 (Jellyman 1993). As the fishery was regarded as "fully developed" at that time, a policy (now regulation) to not issue further fishing permits was implemented in 1986. This has resulted in reasonable stability of effort since this time and the annual average catch has been correspondingly more stable at approximately 1500 t since then. Longfins are the dominant species in the South Island and nationally they constitute about 40% of the total commercial catch.

Growth rates are extremely variable but generally slow. Growth of longfins from Lake Rotoiti averaged only 9 mm y^{-1}, meaning that the average age of female migratory eels would be 93 years (Jellyman 1995). Such long-lived eels are not unique to Rotoiti, as longfins >70 years old have been recorded from the Waiau lakes (Southland) and Lake Coleridge and tributaries (Mitchell and Davis Te-Mairie 1994, 1995). To repeat comments from my Rotoiti paper, "If this (slow growth) is typical of other lakes in New Zealand's national parks, there must be real doubts about the ability of such areas to provide adequate reserve breeding stocks for the whole of the country. As longfinned eels are endemic to New Zealand, management of the fishery must be conservative to allow for such longevity".

2. Specific issues

2.1 RECRUITMENT OF LONGFIN GLASS-EELS

There are concerns, partly raised by NIWA from reviewing the age distribution of populations in three study streams (Public Good Science Fund, PGSF research). MFish regard the issue as significant also and have invited research tenders to investigate the data which can be used and outline a monitoring strategy for future use.

2.2 PROPORTION IN NELSON LAKES

About 6% of New Zealand lakes have no commercial fishing and access to the sea. For the South Island, the Nelson Lakes represent 4.6% of the area of unfished lakes and 4.2% of the New Zealand total (Table 1). In reality, all the North Island area (Lake Waikaremoana) has been inaccessible to eels until recently, while 73% of the South Island area is affected by the Manapouri Power Scheme (which diverts 86% of the outflow from lakes Manapouri and Te Anau and will kill 100% of migratory eels that become entrained). The Nelson Lakes contribute 17% of the area of lakes within New Zealand unaffected by hydro development (Table 2).

2.3 VALUE OF MAINTAINING EEL POPULATIONS IN LAKES ROTOITI AND ROTOROA

As there are very few areas outside of National Parks and various reserves that have not been commercially fished, a significant value for the lakes is as future breeding stock. Although the females will be old at migration, their fecundity will be enormous, e.g. 5 million eggs. Unpublished results from NIWA's PGSF programme indicate there are no geographically separate stocks of longfins (or shortfins) throughout New Zealand, hence it is not a question of adequate escapement of migratory eels from individual catchments, but adequate collective escapement from catchments throughout the country.

A further reason to maintain unharvested stocks is as a "yardstick" for comparison with harvested stocks. Obviously it is important to compare "like with like", but we could compare the abundance and age distributions of eels from Rotoiti/Rotoroa with eels from, say, the upper Clutha lakes to see what impact Roxburgh Dam has had on recruitment.

I have estimated the natural mortality rate of Rotoiti eels as Z = 0.02 (Jellyman 1995), i.e. an average natural "mortality" (which includes emigration of mature eels) of 2% per annum - this is extremely low and would indicate that there is little, if any, "surplus" stock that could be harvested before inroads would be made into the size of the stock itself.

2.4 KAHURANGI NATIONAL PARK

I regret that I cannot provide very complete answers to questions about management of eel populations in rivers of Kahurangi National Park, South Island.

Boundary to distinguish fast- and slow- growing eel populations

The 240 m contour (Jowett & Richardson 1986) was a convenient one for differentiating between diadromous and non-diadromous species. However, from unpublished West Coast data (Bob McDowall, NIWA, Christchurch, pers. comm.), the 200 m contour is a more appropriate one - again, this is based on fish distributions, but altitude will be a more important factor than distance

inland; at >200 m there are no shortfin eel populations on the West Coast but 60% of longfin populations. The implicit assumption that growth rate is related to temperature, is generally true for eels.

Comparative aging data elsewhere in the South Island

No comparable habitats have been sampled to my knowledge - however, we are now accumulating an extensive South Island eel age database via the catch-sampling programme for the Ministry of Fisheries. There are limited age data for the Grey and Buller Rivers for eels >40 cm, and growth rates from the Buller River are very similar to those recorded from Lake Rotoiti. From these data (Beentjes and Chisnall in press), and similar data from Mitchell and Davis Te-Mairie (1994, 1995), I note that longfins > 50 years old are not uncommon in many South Island rivers.

Effects of eel harvest on native fish communities

There has been no research on this.

Likely impacts of eel harvest on high-valued native fisheries like short-jawed kokopu

In the absence of specific research we can only make reasonable speculations. Given the habitat differences between short-jawed kokopu and longfins, the impact of eel removal would be expected to be limited. However, removal of large fish-eating eels could have a marked impact on giant kokopu communities as the two species frequently coexist. I would expect some predation by large eels on sub-adult giant kokopu, and consequently some removal of eels should result in an increase in giant kokopu populations.

Ecologically sustainable harvest levels

Ideally this would be done by estimating natural "mortality" (mortality plus emigration of migratory eels) and keeping harvest at that level. This would require aging of 100-150 eels and preferably measurement of a larger sample. Ideally, harvest would occur across the size range present, except that potential female migrants (>75 cm, 1.5 kg) should be fished lightly.

I believe it would be preferable to close some rivers completely rather than set total catch limits over the entire area. This would be easier for management purposes, but would also leave unfished populations as "reserve breeders", i.e. with any level of harvest, there is potential to capture migratory eels, and in the interest of stock well-being this should be minimised.

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Table 1. Estimated area (km^2) of lake habitat for longfinned eels in national parks and reserves

	Nat. Parks	Reserves	Total	(NZ Total)
North island	59	0	59	355
South island	669	37	706	2139
Total	728	37	765	2494

Table 2. Area of lakes (km^2) in national parks unaffected by hydro and accessible in/out to longfinned eels

	Total area	Unaffected b h dro
North Island	59	0
South Island	669	178 (Nelson Lakes = 31 km')
Total	728	178