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ABSTRACT

An eel specimen found on the bank of the Whangaehu River, Mt Ruapehu, in late October/November was examined to determine its species and age, together with its gender and sexual maturity, and also to assess its probable movement pattern prior to death. The location at which the eel was found is significant because it is about 6 km upstream of the Tokiahuru/Mangaehuehu confluence, which used to be a traditional eel fishery location for the local iwi Ngati Rangi, and is the first part of the Whangaehu River where its acid volcano-fed waters are significantly diluted. The specimen was shown to be a subadult female shortfinned eel (*Anguilla australis*), 795 mm long and 1526 g in weight. Age was estimated from sagittal otoliths to be about 31 years in freshwater, and it had lived in a limiting habitat in the last 13 years. Although 'average' water quality has probably improved in the Whangaehu River above the Tokiahuru confluence since the 1995/96 Ruapehu eruption, any causal relationship between that and the eel's location may be coincidental.

Keywords: shortfinned eel, *Anguilla australis*, acid stream, Whangaehu River, Mt Ruapehu.

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1. Introduction

An eel specimen was found by Ross Wallis (Ngamoki Rd, Whangaehu Valley) in recent silt deposits on the true-right bank of the Whangaehu River, Mt Ruapehu, in late Oct/Nov (spring) 2001 at grid reference 261 874 (NZMS 260-S21).

1.1 OBJECTIVES

The objectives were to determine the species and age of the eel, together with its gender and sexual maturity, and also to assess its probable movement pattern prior to death.

1.2 LOCATION

The location at which the eel was found is significant because it is about 6 km upstream of the Tokiahuru/Mangaehuehu confluence, which is the most upstream location eels have been reported (H. Keys pers. obs.), although no records were found in the Freshwater Fish Database. This confluence used to be a traditional eel fishery location for the local iwi Ngati Rangi, and is the first part of the Whangaehu River where its acid volcano-fed waters are significantly diluted. Since the 1995/96 eruption of Mt Ruapehu, the Whangaehu River has not been fed from Crater Lake and so it must have become less acid, because acids and minerals will have leached from upper valley and river sediments. On 9 February 2002, the pH was measured as 3.2 at the Whangaehu bund site (V. Neall pers. comm.).

Acidity in the Whangaehu decreases downstream from Crater Lake but there is significant spatial and temporal variation due to eruptions, rainfall, tributary inflow, and season change. In normal summers and other periods throughout the year when Crater Lake is overflowing, pH is usually in the range 2–3 between the Wahianoa aqueduct (14 km downstream of the bund) and Tangiwai rail bridge (Wells & Fowles 1980). pH rises to 5–7 in this reach during the winters when no overflow occurs, but at any time of the year pH less than 4 has frequently been recorded at Tangiwai, both before and after the water diversion into the Tongariro Power Diversion (TPD) scheme. The TPD appears to have resulted in little change in pH at Tangiwai, but from the Tokiahuru confluence downstream (south of Tangiwai) the pH has decreased by about 0.2. After TPD the median pH has been 7.3 at the Tokiahuru confluence, but a minimum of 2.6 has been measured there.

2. Examination of the eel

2.1 PHYSICAL FEATURES

The eel was presented in a frozen state. After rapid thawing in warm water, it appeared to be well conditioned but partly decomposed. The skin appeared mostly intact, with no evidence of major affliction either through disease or degradation in acid water. Several distinguishing features confirmed its identity as the shortfinned eel (*Anguilla australis*). The eel was 795 mm long and weighed 1526 g, but some allowance needs to be given to the likely shrinkage that occurs in frozen storage, i.e. the life size was probably slightly larger than presented (around 1% length and weight). The morphology was typical of a feeding eel as opposed to a mature migrant.

2.2 DISSECTION

Gut dissection revealed an empty stomach but the hind-gut was 75% full of aquatic molluscs, probably of the genus *Physa* or *Physastra*, but they were too degraded to identify further. These snails may have become available by being displaced from non-acidic streams during earlier rainfall, or they may be available in patches within the Whangaehu River itself. Of course the eel could have also been displaced from non-acidic streams.

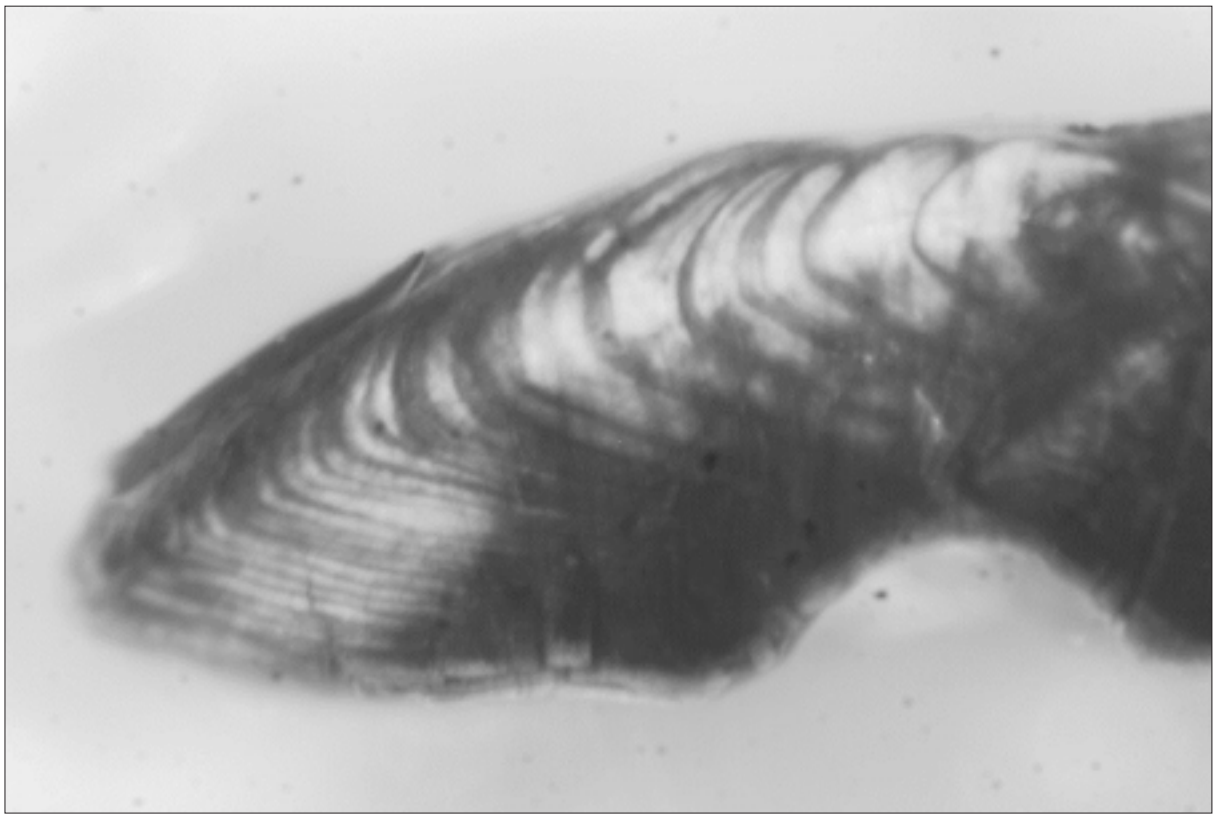
Some early development of female gonads was evident.

According to benthic sampling reported in Wells & Fowles (1980), molluscs are uncommon in the upper Whangaehu catchment. Found only in the Mangawherawhera and Koukuopu Streams 5–20 km downstream from the Tokiahuru confluence, they were recorded as 'rare' or 'scarce' there and were not recorded from the Waitangi Stream 7 km above the eel's location or in the Whangaehu River itself. The Whangaehu becomes devoid of any benthic fauna some distance above Tangiwai.

2.3 AGE AND GROWTH HISTORY

Age was estimated by the cracking and burning of sagittal otoliths, and assessed as around 31 years in freshwater. The otolith growth pattern showed that the bulk of growth would have occurred during the first 11 years of life (Fig. 1). The first 4–5 years of life were represented by narrow banding that probably reflected immigration upstream in the river system. This was followed by six large growth bands indicating rapid growth in a productive environment. Then another eight narrowing bands reflected another growth phase in which the eel had either relocated to a less productive habitat, or had become limited by a lack of fish in the diet. Eels usually become piscivorous when 450–500 mm in length, and when fish are not available, growth slows. Finally, a series of 13 very narrow growth bands were laid down on this specimen.

A



B

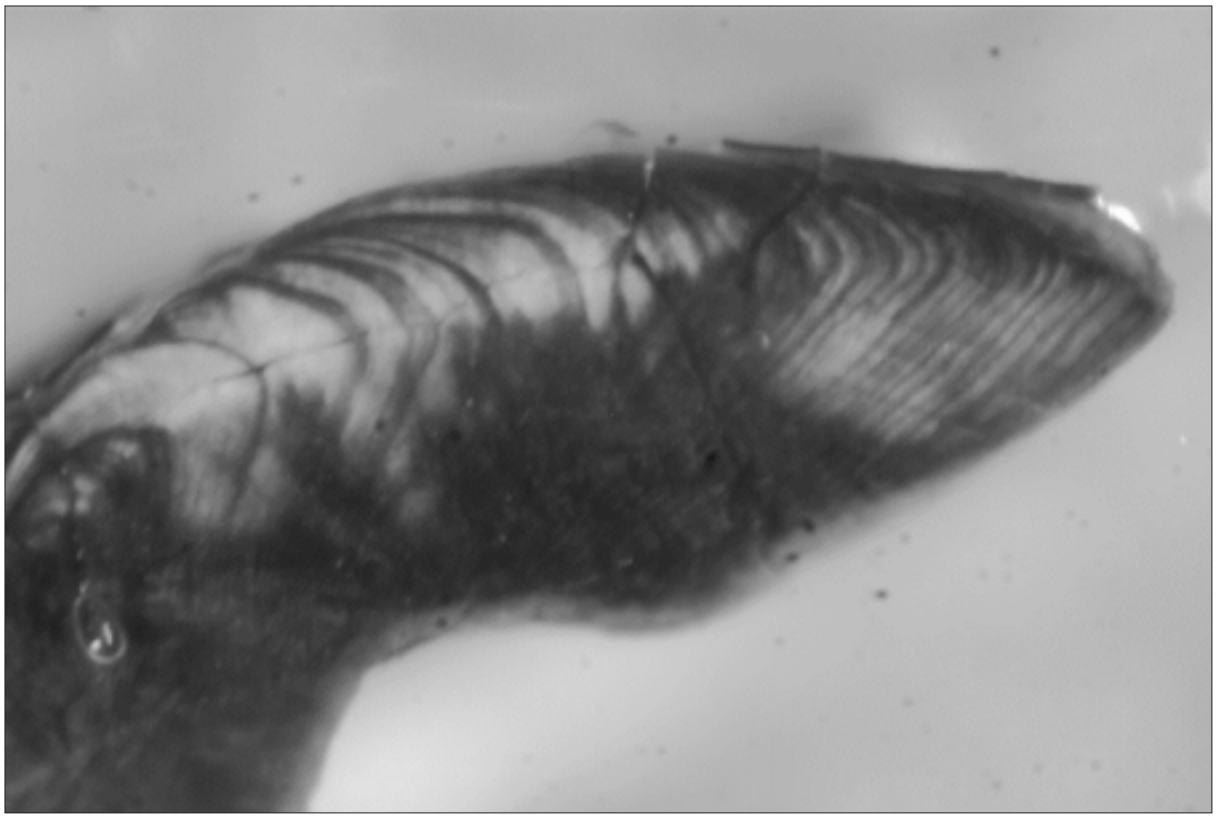


Figure 1. Cross-sections of each of the pair of sagittal otoliths showing (A) the larger growth bands and (B) the centre and outer bands.

3. Discussion

3.1 PAST MOVEMENTS

The eel was found dead after rainfall freshes, and so could have lived anywhere upstream or downstream of where it was found. Several tributaries enter the Whangaehu River within 5 km of the site. Larger eels can be readily displaced through habitat degradation, and this may have occurred here. For example, displacement of the eel from the Tokiahuru Stream could plausibly account for its occurrence in Whangaehu River, with it then travelling 6 km upstream in water of relatively low pH until death. Residence in other streams followed by displacement is just as possible, given they have reasonable water quality.

3.2 PAST GROWTH

This was a subadult female shortfinned eel with a morphology typical of a feeding eel that had lived in a limiting habitat in the last 13 years of its life. Several explanations are possible for its poor growth in these last years. The snails in the gut are unlikely to have been available within the last habitat as a long-term resident because the eel had eaten a reasonable fill over a short recent period and snails are known to result in reasonable growth for shortfinned eels of this size. Therefore the habitat that caused poor growth is most likely accounted for by: either prevailing acidic conditions in the habitat that are extremely limiting for invertebrate production; or poor food production in non-acidic high-altitude ring plain streams.

A further possible explanation for the abrupt change in growth could be manual transplantation as a young eel by humans. However, this is thought to be unlikely.

Although 'average' water quality has probably improved in the Whangaehu River above the Tokiahuru confluence since the 1995/96 Ruapehu eruption, any causal relationship between that and the eel's location may be coincidental and cannot be proven.

4. Reference

Wells, P.C.; Fowles, C.R. 1980: Water resources of the Whangaehu River. Rangitikei–Wanganui Catchment Board, Palmerston North. 175 p.