

Kakahi shell deformity index Version 1

Ngairé Phillips, May 2007

The kakahi (freshwater mussel, *Hyridella* sp) shell deformity index has been designed to provide a relative measure of the extent of internal shell deformities within kakahi. This measure is complementary to others which aim to assess the condition of individual animals and provides a basis for assessing the relative integrity of kakahi shells. Internal shell deformities are largely associated with the presence of the commensal Chironomid *Xenochironomus canterburyensis*, which spends much of its life cycle within the kakahi (Forsyth and McCallum, 1978). As the kakahi grows the larvae may irritate the mussel, resulting in growth of the nacreous layer and burial of the larvae. This growth appears as bumps on the inside of the shell. In addition, there appears to be a strong relationship between thickening of one end of the shell and the extent of Chironomid infestation (N. Phillips, unpublished data), with more intensive growth of the periostracum near the region where the Chironomids a most likely explanation for this thickening (Forsyth and McCallum, 1978).

This index is therefore based on these two measurements:

1. extent of internal shell deformities from Chironomid infestation as well as other irritations leading to extension of the nacreous layer, and
2. presence of shell end thickening, such that one end of the shell is at least 10% thicker than the other end

There are 5 possible grades (1 – 5) based on the presence, extent and combination of the above characteristics. The following guide provides photographic examples of each of the possible grades.

Kakahi Monitoring

An overall assessment of kakahi condition, as might be undertaken in a monitoring programme, should include a suite of measures. It is recommended that the shell deformity index be used in conjunction with:

- the shell erosion index (Roper and Hickey, 1994)
- condition indices (Roper and Hickey, 1994), and
- shell strength (measured using a penetrometer, N. Phillips, unpublished data)

A minimum sample size of 20 individuals is recommended. It is also recommended that an archive of dried kakahi shells be established and maintained to provide a suitable reference against future monitoring and assessment.

Notes on the Guide

All photographs were taken by Ngairé Phillips. The examples presented have been collected from various lakes within the Rotorua region. ROI1, ROI2 = Rotoiti; ROT1, ROT2 = Rotorua, TAR1, TAR2 = Tarawera; KAK1 = Rotokakahi; TUT1 = Tutaeinanga.

References

Forsyth D, McCallum I 1978. *Xenochironomus canterburyensis* (Diptera: Chironomidae), a commensal of *Hyridella menziesi* (Lamellibranchia) in Lake Taupo; features of pre-adult life history. New Zealand Journal of Zoology 5(4): 795 - 800.

Roper D, Hickey C 1994. Population structure, shell morphology, age and condition of freshwater mussel *Hyridella menziesi* (Unionacea: Hydridae) from seven lake and river sites in the Waikato River system. Hydrobiologia 284: 205 - 217.

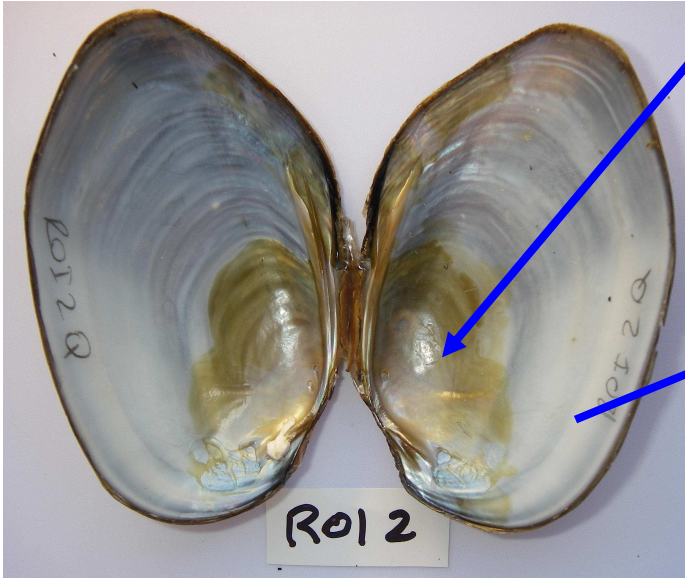
Acknowledgements

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Examples of the scoring system

Grade 1 (good shell integrity)

Shell staining or discolouration **is not** considered a shell deformity.



No internal shell deformities



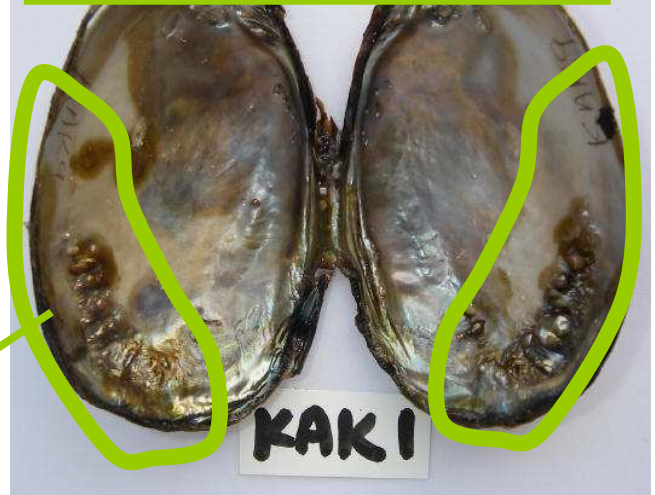
Enlargement to show lack of shell deformities (smooth shell)



No shell end thickening – similar width both ends

Grade 5 (very poor shell integrity)

Shell deformities are mainly found on the bottom half of the shell



Extreme internal shell deformities

Protrusions caused by Chironomids



Enlargement to show shell deformities associated with Chironomids

>10% difference in thickness



Shell end thickening evident

Grade 1

No internal deformities or shell thickening.



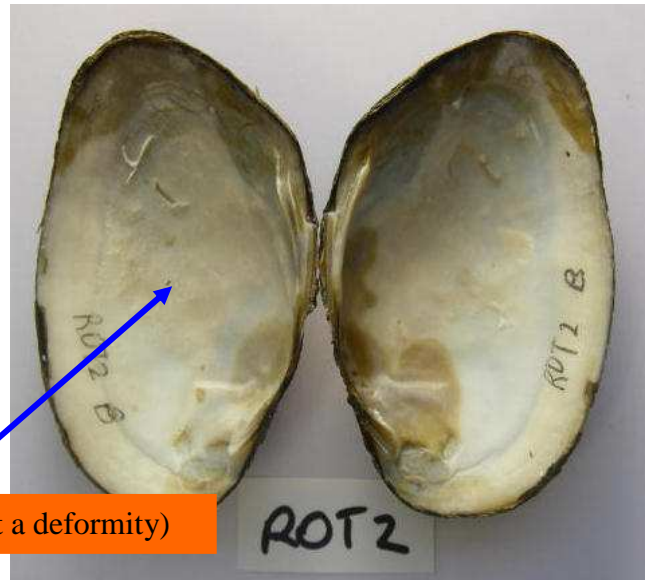
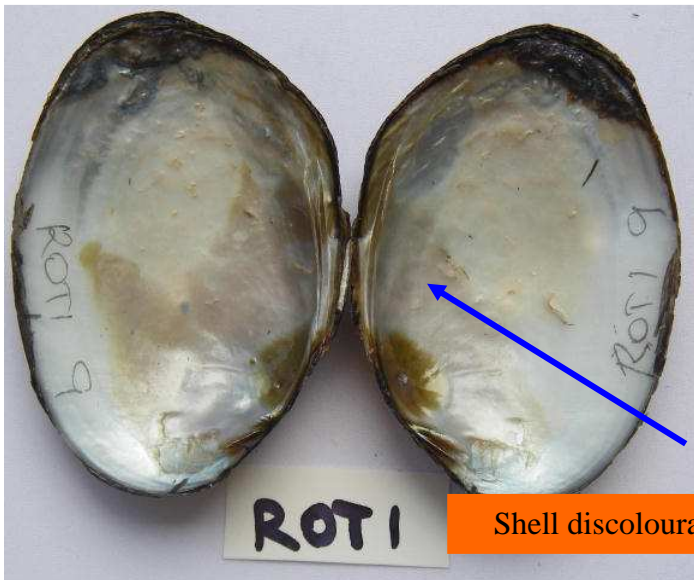
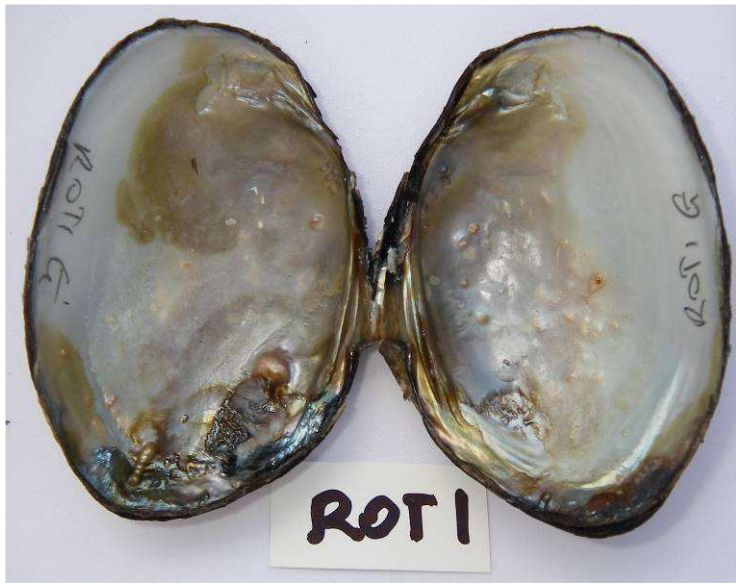
Grade 2 (a)

No internal deformities BUT shell thickening evident (rarely found)



Grade 2 (b)

OR minor internal deformities, but no shell thickening

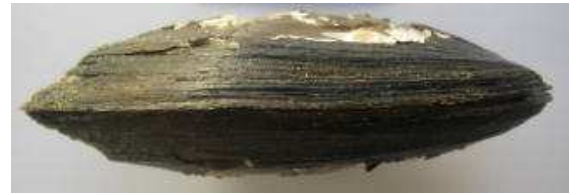


Shell discolouration (not a deformity)



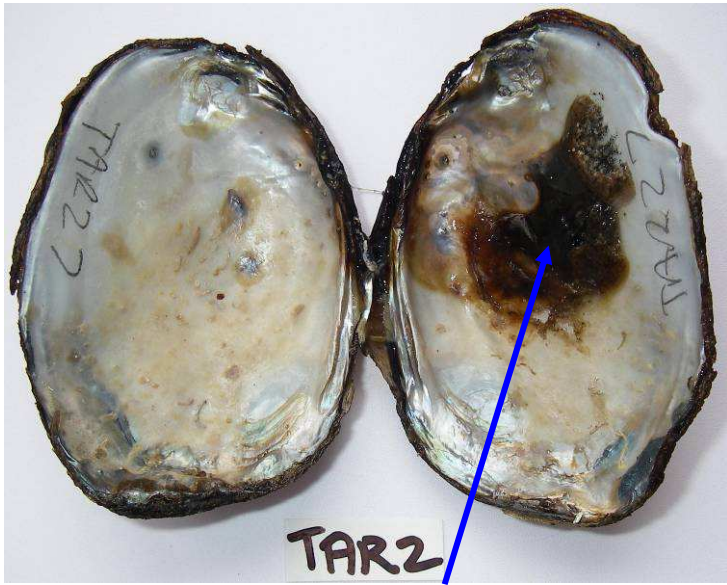
Grade 3 (a)

Moderate internal deformities, but no shell thickening



Grade 3 (b)

OR minor internal deformities PLUS shell thickening



Shell discolouration (not a deformity)



Grade 4 (a)

Moderate internal deformities PLUS shell thickening



Grade 4 (b)

OR extreme internal deformities, no shell thickening



Grade 5

Extreme internal deformities PLUS shell thickening

