Tabled at Hearing on 16 November 2015

BEFORE THE CANTERBURY REGIONAL COUNCIL

IN THE MATTER OF: the Resource Management Act 1991

AND

IN THE MATTER OF: a submission on the partially operative Canterbury Land and Water Regional Plan – plan change 3

EVIDENCE OF DR NICHOLAS REX DUNN
FOR DIRECTOR-GENERAL OF CONSERVATION

Dated 25 September 2015

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STATEMENT OF EVIDENCE OF NICHOLAS REX DUNN

INTRODUCTION

1. My full name is Dr Nicholas Rex Dunn.

2. I am appearing on behalf of the Director-General of Conservation. I am employed by the Department of Conservation (DOC) as a Freshwater Science Advisor in the Freshwater Section of the Science & Policy Group. I have held this role since September 2012. I was employed by the Department as a Technical Support Officer Freshwater in the Canterbury Conservancy between December 2010 and September 2012.

3. I hold a Bachelor of Science (Earth Sciences) degree from the University of Waikato where I majored in hydrology and soil science, and a Master of Science (Environmental Science) (First Class Honours) degree from the University of Canterbury, majoring in freshwater ecology and hydrology. I also hold a Doctor of Philosophy degree from the University of Otago, in which I investigated aspects of the influences of flow regimes on the ecology of non-migratory galaxias fishes.

4. I am familiar with Canterbury mudfish. Dr Leanne O'Brien (whose thesis focused on the conservation ecology of Canterbury mudfish (*Neochanna burrowsius*)) and I have co-authored a number of publications and reports detailing Canterbury mudfish, their habitats, and conservation management.

5. I have undertaken field surveys or visited waterbodies within the South Coastal Canterbury sub-regional area periodically since 2002, most recently in September 2015.

6. I have read the Environment Court's Code of Conduct for Expert Witnesses, and I agree to comply with it. My qualifications as an expert are set out above. I confirm that the issues addressed in this brief of evidence are within my area of expertise.

7. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

8. My evidence provides a native fish perspective on the matters raised in the Director-General's submission on Variation 3 of the Canterbury Land and Water Plan. Specifically, my evidence provides an overview of freshwater fish species within the South Coastal Canterbury sub-regional area, and in detail addresses the need for identification and protection of Canterbury mudfish habitats.

FRESHWATER FISH COMMUNITIES AND HABITATS OF THE SOUTH COASTAL CANTERBURY SUB-REGIONAL AREA

9. The South Coastal Canterbury sub-regional area contains a variety of freshwater habitats including Wainono Lagoon, braided river, wetlands (typically swamps) spring-fed streams, hill streams, meandering valley floor streams and intermittently connected ponds. Within these habitats occur a range of freshwater fish (Table 1), two of which are categorised as Threatened (Goodman et al. 2014). Fish communities differ in composition between water body types and position in the landscape.

10. Migratory species are those that require passage to and from the marine environment to the freshwater environment to complete their life cycle. For non-migratory species there is no marine phase, with spawning and rearing occurring within the adult habitat. For migratory species, there are two major periods of downstream movement, viz. March – May, and October – November, and a period of upstream movement of August – October inclusive. Non- migratory species predominantly spawn in the September- November period. These periods represent the 'shoulder months' of the irrigation season.

Table 1. Native freshwater fish and macroinvertebrates in the South Coastal Canterbury sub-regional area as recorded in the New Zealand Freshwater Fish Database (NZFFD) and Benn (2011a, b, c, d). Umbrella categories and conservation status from Goodman et al. (2014). Taonga species status from the Ngāi Tahu Claims Settlement Act 1998. Life history from McDowall (2000).

Common name	Species name	Umbrella category	Conservation status	Taonga species	Life history
Canterbury mudfish	*Neochanna burrowsius*	Threatened	Nationally Critical	Taonga	Non-migratory
Lamprey	*Geotria australis*	Threatened	Nationally Vulnerable	Taonga	Migratory
Longfin eel	*Anguilla dieffenbachii*	At Risk	Declining		Migratory
Torrentfish	*Cheimarrichthys fosteri*	At Risk	Declining	Taonga	Migratory
Giant kokopu	*Galaxias argenteus*	At Risk	Declining	Taonga	Migratory
Koaro	*Galaxias brevipinnis*	At Risk	Declining		Migratory
Inanga	*Galaxias maculatus*	At Risk	Declining		Migratory
Canterbury galaxias	*Galaxias vulgaris*	At Risk	Declining		Non-migratory
Bluegill bully	*Gobiomorphus hubbsi*	At Risk	Declining		Migratory
Redfin bully	*Gobiomorphus huttoni*	At Risk	Declining		Migratory
Yelloweye mullet	*Aldrichetta forsteri*	Not Threatened	Not Threatened		Migratory
Shortfin eel	*Anguilla australis*	Not Threatened	Not Threatened		Migratory
Banded kokopu	*Galaxias fasciatus*	Not Threatened	Not Threatened		Migratory
Upland bully	*Gobiomorphus breviceps*	Not Threatened	Not Threatened		Non-migratory
Common bully	*Gobiomorphus cotidianus*	Not Threatened	Not Threatened		Migratory
Giant bully	*Gobiomorphus gobioides*	Not Threatened	Not Threatened	Taonga	Migratory
Common smelt	*Retropinna retropinna*	Not Threatened	Not Threatened	Taonga	Migratory
Black flounder	*Rhombosolea retiaria*	Not Threatened	Not Threatened		Migratory

CANTERBURY MUDFISH (*Neochanna burrowsius*)

11. Canterbury mudfish is an indigenous freshwater fish species found in sixteen river catchments from the south bank of the Ashley River to the south bank of the Waitaki River (NZFFD; O'Brien & Dunn 2007a).

12. Under the New Zealand Threat Classification System (Townsend et al. 2008), Canterbury mudfish has the highest conservation status of any native freshwater fish in the South Canterbury Coastal Streams area. Its classification of Threatened – Nationally Critical, is based on the criteria that irrespective of size or number of subpopulations it has a very high (>70%) ongoing or predicted decline (Goodman et. al. 2014).

13. Furthermore, the three qualifiers of Conservation Dependant, Range Restricted, and Sparse apply for the threat classification for Canterbury mudfish. Conservation Dependant means 'the taxon is likely to move to a higher threat category if current management ceases' (Townsend et al. 2008, p 28). The next highest classification is Extinct. Range Restricted means 'taxa confined to specific substrates, habitats or geographic areas of less than 1000 $km^{2,}$ (Townsend et al. 2008, p 29). Sparse means 'taxa that occur within typically small and widely scattered populations' (Townsend et al. 2008, p 30).

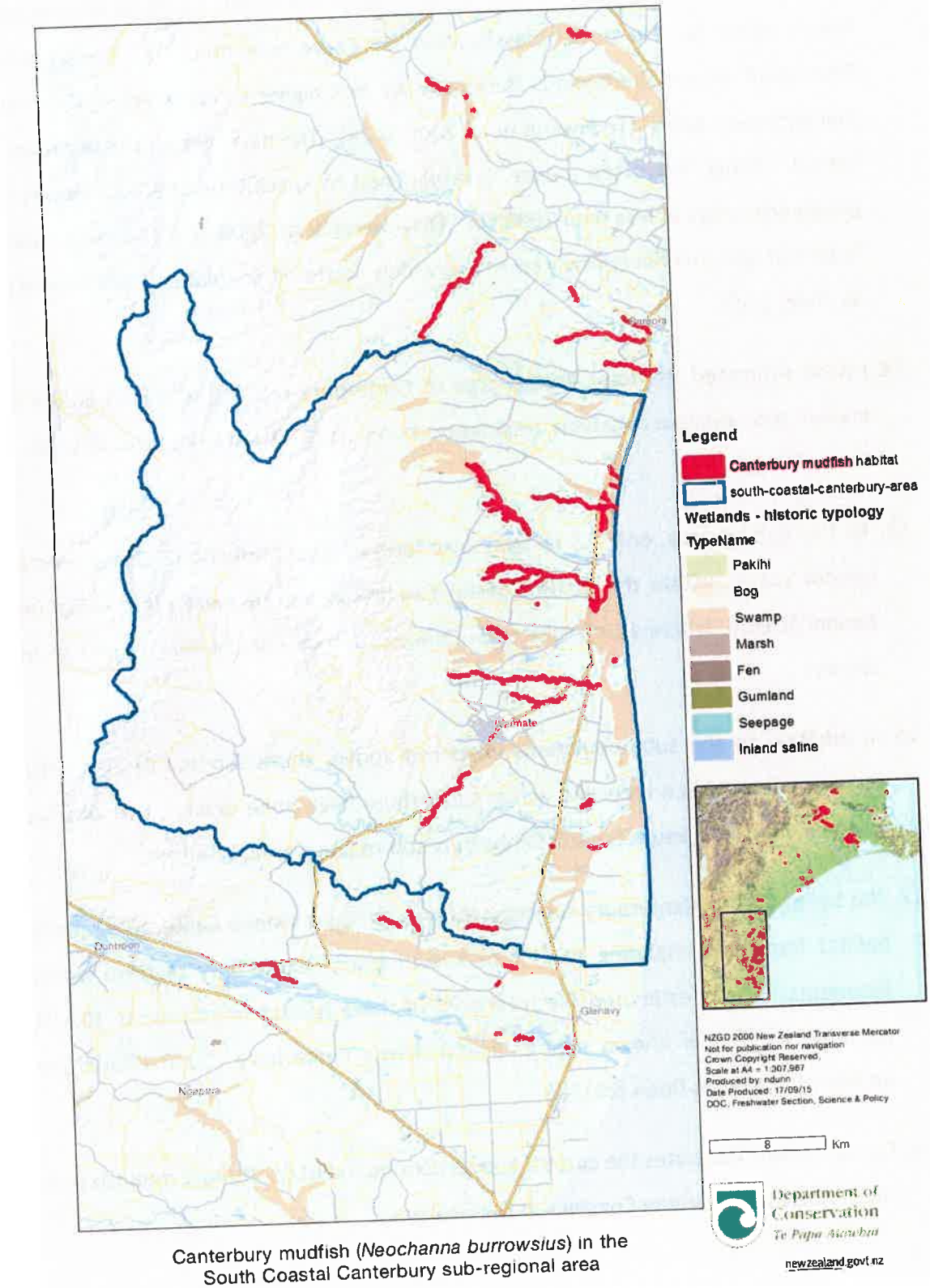
14. I have estimated the total habitat area of Canterbury mudfish as 32 ha across 89 known sub-population habitat fragments (Dunn unpublished update of O'Brien & Dunn (2012)).

15. Of this habitat area, only 1.5 ha has some form of legal protection. One protected habitat occurs within the South Coastal Canterbury sub-regional area, being Dog Kennel Stream, where a Department of Conservation covenant exists on part of the stream.

16. In addition to the sub-populations described above, thirty sub-populations which have previously been recorded across Canterbury have gone extinct, two of which occured within the South Coastal Canterbury sub-regional area.

17. The South Coastal Canterbury sub-regional area contains sixteen Canterbury mudfish habitat fragments, equating to 13% of known extant Canterbury mudfish habitat fragments. I have estimated the total area of these habitat fragments as 10.5 ha, equating to 33% of known extant habitat across Canterbury (Dunn unpublished update of O'Brien & Dunn (2012)).

18. Figure 1 below illustrates the current known distribution of Canterbury mudfish in the South Coastal Canterbury Coastal sub-regional area.



Canterbury mudfish (*Neochanna burrowsius*) in the South Coastal Canterbury sub-regional area

Figure 1. Distribution of Canterbury mudfish in the South Coastal Canterbury sub-regional area. Map produced by N.R. Dunn.

19. Recent work (2013-2014) by the Department of Conservation, as well as the Wainono Restoration Project (described in Dr Gerbeaux's evidence) has meant Canterbury mudfish have been recorded from a number of previously un-surveyed streams. This has increased both the number of known sub-populations, and estimated area of occupancy.

20. Canterbury mudfish are wetland specialists (O'Brien & Dunn (2007b). Their habitats are still or very slow-flowing, meandering, swampy streams with deep pools, seepage streams, spring fed streams, scour holes and stockwater races. The diverse range of habitats in which Canterbury mudfish are now found may be, in part, a consequence of the removal of the once extensive wetlands that covered the Canterbury Plains which has forced mudfish to occupy whatever habitat remains that they can tolerate (O'Brien & Dunn 2007b).

21. Specifically, the mudfish habitats in the South Coastal Canterbury sub-regional area are small, highly meandering streams on the flat valley floors of the rolling downlands, and spring fed streams nearer the coast. An example is Dog Kennel Stream, which is a perennial, and low volume (<5 $L \cdot s^{-1}$) seepage stream, with steep sided pools dominated by floating aquatic macrophytes, that once flowed to the sea through coastal swamps (Eldon 1979). Between pools, channels are typified by swales, which may be dominated by terrestrial rushes and grasses, but which carry flows at various times of the year. When identifying Canterbury mudfish habitat these ephemeral water courses should also be included as part of the habitat whether wet or dry. Another example of mudfish habitat is the Arno wetland and the Waikokopara Stream that flows from it, inland of the Waimate Gorge. Characteristic of Canterbury mudfish habitats are aquatic macrophytes upon which eggs are laid in the spring. The presence of floating duck weed (*Lemna minor*) and azolla fern (*Azolla filiculoides*) are indicators of slow water velocities in Canterbury mudfish habitats.

THREATS TO CANTERBURY MUDFISH

Habitat loss

22. Habitat loss is considered to be the greatest threat to the long term persistence of remaining populations of Canterbury mudfish (DOC 2003). This can occur through wetland drainage, habitat infilling, or channelisation modifying hydrological conditions, especially increasing water velocity.

23. The Director General of Conservation's submission sought the inclusion into the plan of a schedule identifying Canterbury mudfish habitats, and a rule to assist in habitat protection. This sought to address Recommendation 1.1 of the South Coastal Canterbury ZIP Addendum includes the recommendation "identification and protection of remnant mudfish populations throughout the area by avoiding habitat damage and predator (e.g. trout) access".

24. In my opinion, the identification of mudfish habitats and notification through a schedule is a critical step in the process of protecting habitats and preventing extinction of more sub-populations.

25. The habitats occupied by Canterbury mudfish are often small in spatial extent, and can reduce in size or dry completely during extended drought events. To some extent Canterbury mudfish can tolerate a lack of water as they possess traits affording them a degree of tolerance to emersion (O'Brien & Dunn 2007b), allowing them to re-establish themselves once water returns to a habitat.

26. These characteristics of Canterbury mudfish habitats may mean they are not viewed as aquatic habitat by landowners/managers, therefore their identification by experts and by way of a schedule is required.

27. I am aware of instances of habitat destruction when habitats have been dry over the period of the 2014-2015 drought event. For example during a site visit in March 2015 I observed that in the Hororata River catchment, a known Canterbury mudfish wetland had been subjected to complete riparian vegetation removal, channel re-

contouring and realignment (Figure 2). The landowner was preparing the area for a centre pivot irrigator, and had been granted resource consent to install bridges for the pivot wheels. Despite this level of destruction, in their Compliance Monitoring Report (Document No. C15C/26268) the Canterbury Regional Council Resource Management Officer stated: *"The works are a breach of the proposed Land and Water Regional Plan and enforcement action could take place. We understand the consent holder and the consultant are very keen to ensure the damage is remediated however, so in this instance enforcement action will not take place."*. At this time it is unclear if Canterbury mudfish still exist at this site. Immediately upstream at another site, which had also dried, but not subjected to habitat modification, Canterbury mudfish were not found to be present by DOC staff in August 2015. The downstream, modified site had deeper pools than the upstream site, meaning that Canterbury mudfish may have been able to survive the drought, but not the subsequent earthworks and habitat modification.

Figure 2. The Hororata River Canterbury mudfish wetland downstream of Mitchells Rd. A – the upper section circa 1999, B – the upper section in March 2015, C – the duckpond circa 1999, D – the duckpond circa 1999, the scour hole in March 2015, looking upstream to the duckpond in March 2015. Photos by L.K. O'Brien (A, C, D), and N.R. Dunn (B, E, F).

28. In the South Coastal Canterbury sub-regional area, on a recent visit (11 September 2015), I observed that the channel downstream of Wallaces culvert on State Highway 1 had been re-contoured, realigned, and channelised (Figure 3). The consequences for the Canterbury mudfish are yet to be determined, however Canterbury Regional Council caught mudfish in this area as part of the Wainono Restoration Project in 2013, so data exists to make before and after comparisons.

Figure 3. The reach downstream of Wallaces culvert, showing the realigned channel, re-contoured bed and banks, and lack of a set back to the cultivated ground. Photos by N.R. Dunn.

29. The effect of habitat modification is a reduction in quality habitat area, and a reduction in population size. This latter point is exemplified by the land development (drainage and channelization) of the 175 ha Mounseys wetland/Te Roto Repo o Tawera block in 2008 (Figure 4). This habitat was considered by Eldon (1993) as one of the four most important habitats for supporting Canterbury mudfish populations. Moreover, O'Brien (2005) considered this site with perennial hydrology, and low agricultural development, to have a high density Canterbury mudfish population with low fluctuations in abundance over the course of her study.

30. I have analysed the available data (NZFFD) to illustrate the effects of this drainage and realignment of waterways at Mounseys wetland/Te Roto Repo o Tawera on Canterbury mudfish densities, given as catch per unit effort (number of fish per trap per night). As shown in Figure 5, following habitat modification (channelisation and drainage) the Canterbury mudfish population has not returned to pre modification

densities, even in the long term. This situation is likely to occur at the other sites given as examples, and clearly demonstrate the effect of habitat modification and loss on Canterbury mudfish sub-populations.

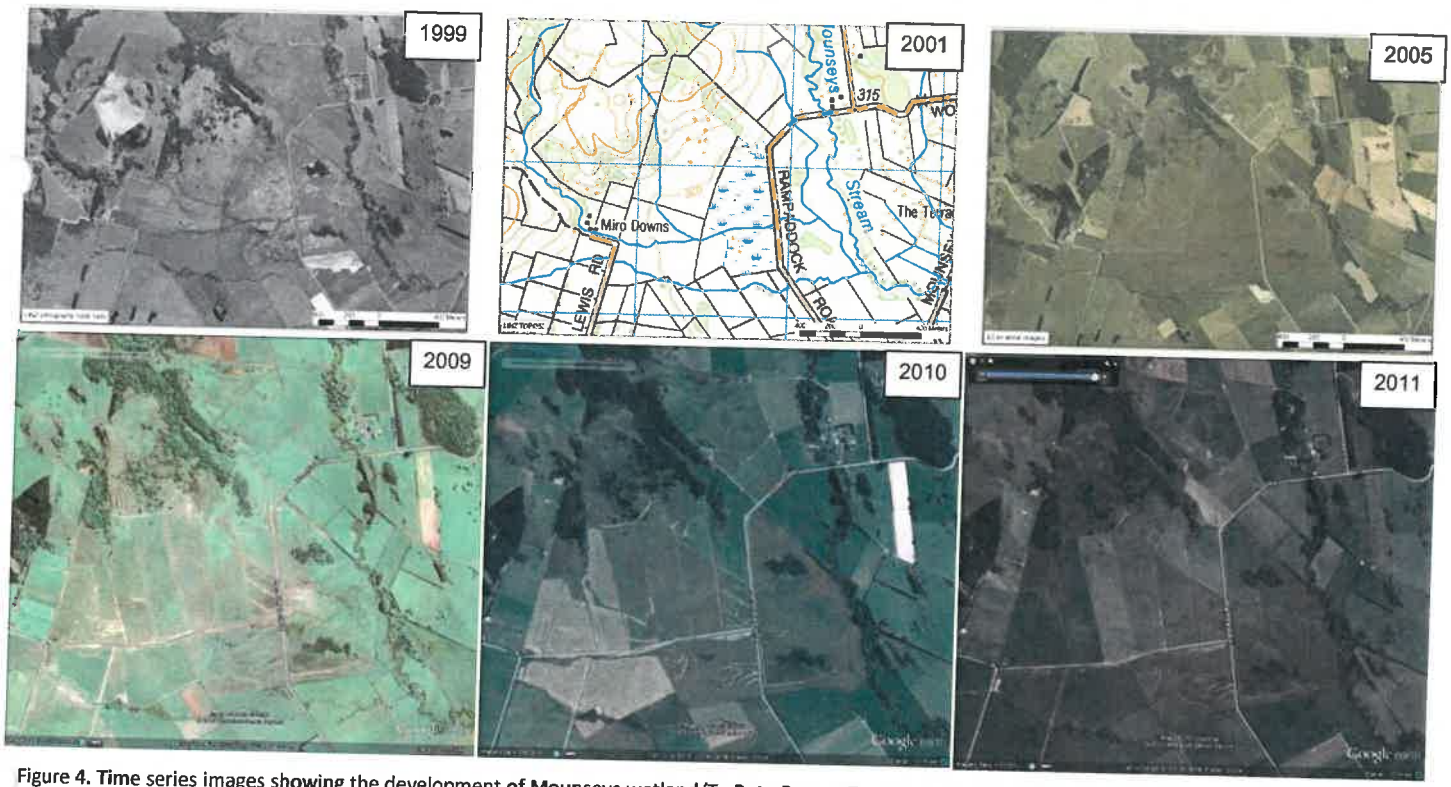


Figure 4. Time series images showing the development of Mounseys wetland/Te Roto Repo o Tawera, near View Hill. Major drainage works were initiated in 2008 converting the once extensive wetland into a series of paddocks (note light coloured drains in imagery from 2009, 2010, and 2011, compared to 1999 and 2005). Imagery sourced from Land Information New Zealand, Canterbury Regional Council, and Google Earth.

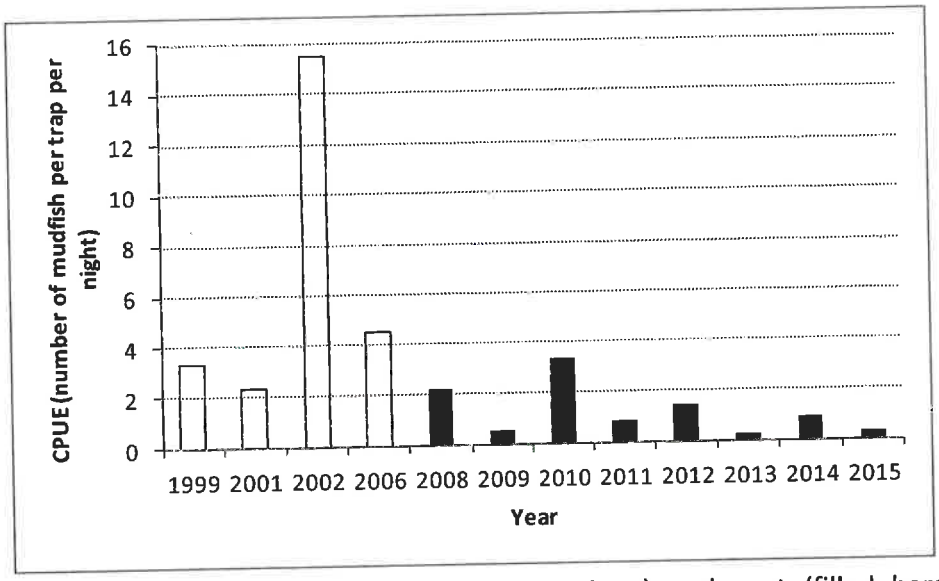


Figure 5. Canterbury mudfish densities pre (open bars) and post (filled bars) habitat modification. CPUE (Catch Per Unit Effort).

Water augmentation

31. Another threat to Canterbury mudfish is the presence of other fish species (Cadwallader 1975; Eldon 1979). In our review (O'Brien & Dunn (2007b)) Dr O'Brien and I analysed NZFFD records to identify how often Canterbury mudfish are present with other species. We showed that Canterbury mudfish were found alone in 60 % of records. Co-occurrence with migratory eels occurred at less than 7 % of records, and trout at less than 2 % of records. Meredith (1985) as summarised by O'Brien & Dunn (2007b) considered that Canterbury mudfish have poor predator avoidance mechanisms, being generally intolerant of competition due their small size, lack of aggression, small mouth and low metabolic rate, all of which may reduce their potential to be dominant competitors. Moreover, O'Brien (2005) considered co-occurrence with eels was mediated by drying and low flow events that periodically eliminated eels. Thus, the persistence of Canterbury mudfish is negatively related to the hydrological connectedness of their habitats to other sections of waterway and the ocean. Therefore, these traits of Canterbury mudfish need careful consideration when increasing minimum flows, fish passage works, and river mouth openings are being proposed.

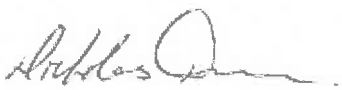
32. In this respect, any proposal to augment flows in water bodies connected to mudfish habitat, (such as into the Hook River as part of the Wainono Lagoon augmentation project) needs to carefully consider the consequences of increasing flows that increase the probability of predatory species accessing Canterbury mudfish habitats higher in the catchment.

CONCLUSIONS

33. Canterbury mudfish are nationally critically threatened, they occur in remnant wetlands and highly meandering streams and springs.

34. Canterbury mudfish habitat has been identified by experts recently working in the South Coastal Canterbury sub-regional area.

35. Habitat loss and predation are their greatest threats to the long term persistence of Canterbury mudfish sub-populations.



Nicholas Rex Dunn

25 September 2015

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