IN THE MATTER OF	the Resource Management Act 1991
A N D	
IN THE MATTER OF	an application for a Water Conservation Order pursuant to section 201 of the Act
BY	**NEW ZEALAND AND NORTH CANTERBURY FISH AND GAME COUNCILS AND NEW ZEALAND RECREATIONAL CANOE ASSOCIATION**
	Applicants

STATEMENT OF EVIDENCE OF RICHARD MARK ALLIBONE
FOR AMURI IRRIGATION COMPANY LIMITED
DATED 23 MARCH 2009

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RICHARD MARK ALLIBONE states:

Qualifications and Experience

1 My name is Richard Mark Allibone, a senior ecological consultant at Golder Associates (NZ) Ltd. I have been in practice as a freshwater and terrestrial scientist and manager for 12 years.

2 I have a BSc (Geology and Zoology), an MSc (Zoology) and a PhD (Zoology) from the University of Otago.

3 I have previously been employed as the National Services Manager for the Queen Elizabeth the Second National Trust (QEII); Species Protection Officer at the Biodiversity Recovery Unit of the Department of Conservation; Fisheries Scientist and Post Doctoral Fellow at the National Institute of Water and Atmospheric Research (NIWA) and a Freshwater Fisheries Specialist for the Department of Conservation in the Nelson/Marlborough and Otago Conservancies.

4 I have previously reviewed hydro-electric power scheme consent applications for Meridian Energy Ltd North Bank Tunnel Concept (NBTC) on behalf of Environment Canterbury; and Contact Energy Ltd's Roxburgh, Clyde and Lake Hawea operations on behalf of the Department of Conservation (DoC). I was also part of the DoC team assessing application for resource consents for TrustPower Ltd's Waipori hydro electric power scheme.

5 I am currently providing expert evidence for DoC with respect to up and downstream fish passage for native fish at the proposed Mokihinui Dam.

6 I have previously assessed fish screen requirements for the Central Plains Water Enhancement Scheme intakes on the Waimakariri and Rakaia Rivers. In addition, I was a fisheries technical expert for the Department of Conservation during the assessment and negotiations with Meridian Energy with regard to Project Aqua.

7 As a senior member of the freshwater staff at the Department of Conservation I also gave advice to Conservancy staff with regard to the reviewing of the assessment of effects.

8 As a reviewer of the NBTC and Hunter Downs Irrigation Scheme consent applications I reviewed all aspects of the fisheries evidence which covered effects on native fish, trout and salmon and salmon angling in the Waitaki River. I undertook a monitoring programme to assess the effectiveness of the salmon passage barrier on the Highbank Power Station tailrace on the Rakaia River.

9 I have undertaken freshwater fisheries surveys across Stewart Island, South Island and the Chatham Islands targeting rarer native fish. As a species protection officer in the BRU I led the team that produced the three threatened species recovery plans for the large whitebait species, mudfish and non-migratory galaxiids. I was the recovery group leader for the non-migratory galaxiid recovery group and also a member of the other two recovery groups.

10 I developed and delivered freshwater fisheries training courses to DoC staff and undertook the development of survey methods and population monitoring strategies for a suite of threatened fish. I was also a member of the freshwater fish committee that determined the threat rankings for New Zealand's native fish in 2002 and 2005 and I currently chair the threatened fish committee for DoC (an honorary position) that is undertaking the 2009 threat ranking for freshwater fish.

11 I have been a contributing author to two books and 24 peer reviewed papers and reports.

12 I have read the code of conduct for expert witnesses as set out in the Environment Court Consolidated Practice Note 2006. I have complied with it whilst preparing my written statement of evidence and I agree to comply with it as I give my oral evidence. I confirm that this evidence is within my area of expertise

Scope of Evidence

13 I have been asked by the Amuri Irrigation Company Limited (AIC) to provide evidence regarding the proposed fish screen requirements of the Hurunui River Water Conservation Order (WCO) application by Fish and Game New Zealand.

14 I have also been asked to comment on native fish in the river in general and to comment on relevant submissions and evidence of Fish and Game, the Director General of Conservation(DoC) and the Royal Forest and Bird Protection Society (Forest and Bird).

15 The key issues I will address are as follows:

(a) Native fish in the Hurunui River with particular reference to threatened species;

(b) The native fish screen requirements at the AIC intake;

(c) Brown trout growth and fish screen requirements;

(d) Summary.

16 In his evidence for AIC, Dr Heiler discusses the design of the AIC intake and the background of the Fish Screen Working Party and the Canterbury fish screen guidelines in some detail. The focus of my evidence is on the fish species present (or likely to be present) in the Hurunui River, their ecology, and the likelihood of them becoming entrained or impinged in the existing AIC intake compared with the proposed design criteria in the WCO application.

Information sources

17 In preparing my evidence, I have read and relied on the following documents and data sources:

(a) The Hurunui WCO application.

(b) Submissions from DoC and Forest and Bird.

(c) Statements of evidence submitted on behalf of Fish and Game by Dr Young, Dr Jellyman, Mr Unwin, and Mr Bejakovich.

(d) Various technical reports and scientific papers (as referenced within).

(e) Data from the New Zealand Freshwater Fish Database (NZFFD).

Hurunui WCO fish screen criteria and the AIC intake

18 The proposed Hurunui WCO minimum fish screen design parameters are as follows:

(a) Aperture size not exceeding 3mm in diameter;

(b) Approach velocity of no greater than 0.12 metres per second;

(c) Sweep velocity that exceeds the approach velocity at all times; and

(d) Where necessary, a bypass channel that ensures the safe return of fish to an active flowing channel of the water from which they were diverted.

19 The AIC intake on the Hurunui River is comprised of two rotary drums with a square mesh opening of 5 mm, measured along the side of the square. The screens are located at the downstream end of a sediment settling pond. There are two fish return options; the largest fish return is a broad (ca 40 m), shallow (ca 20-25 cm) outlet located on the southern edge of the settling pond. There are also two smaller fish returns located on the north and south sides of the rotary screens.

20 When my colleague, Dr Burrell, visited the intake site on 5 March 2009, the measured velocities using a small Ott current meter immediately in front of each screen, at 2 depths at 5 locations along each screen. The average velocity was 0.15 to 0.16 m^2/s and there was very little variation across each screen. Dr Burrell estimated that the flow down the large fish return was approximately 1-2 m^3/s, using a coarse gauging with a velocity meter. AIC were taking 3.8 m^2/s on the day of the site visit (Norm Williamson, AIC, Pers. Comm).

Native fish of the Hurunui River

Overview

21 The New Zealand Freshwater Fish Database (NZFFD) has 90 records for the Hurunui River catchment that includes 11 native freshwater fish species and one marine wanderer (Table 1). The majority of these are for the upper Hurunui River (above the Mandamus River confluence) concentrated in the North Branch.

22 There is a single record from the Mandamus River, just upstream from its confluence with the Hurunui.

23 There are no other records in the vicinity of the AIC intake and only a few records on the Hurunui River just upstream of the gorge at the downstream river end of the Amuri Plain. Therefore, there is only limited data available to assess the fish fauna in the vicinity of the AIC intake and assess the fish screen requirements.

Threatened Native Fish

24 In its submission, DoC lists a number of threatened native fish as present in the river: giant kokopu, upland longjaw galaxias, Stokell's smelt, longfin eel, and lamprey.

25 Forest and Bird's submission lists 20 native fish species in the Hurunui River including the same threatened species are noted in the DoC submission, and in addition shortjaw kokopu is listed as present.

26 Below I will discuss the likelihood that the listed threatened species are present in the Hurunui River system and whether the proposed fish screen provisions will provide additional protection for these threatened native fish and other native fish over and above that provided by the current fish screen at the AIC intake structure.

27 The NZFFD does not hold any records of **giant kokopu** in the Hurunui River and the DoC submission does not provide any indication of the location of the giant kokopu in the river, nor does it cite any survey information to support the species being present in the catchment. Giant kokopu are not regarded as inhabitants of braided rivers with their preferred habitat being pools with good instream and/or riparian cover. Large populations of giant kokopu are known from some of the South Island's east coast rivers, but they are almost always in catchments with large lagoons and/or lowland lakes that provide larval fish rearing habitat. Larval giant kokopu rearing habitat is absent from the lower Hurunui River and therefore any population of giant kokopu relies on migratory recruitment (whitebait) to sustain the population.

28 The combination of poor habitat, abundant brown trout and low recruitment means, in my opinion that it is extremely unlikely that giant kokopu upstream of or in the vicinity of the AIC intake and the proposed fish screen provisions will not provide any protection for larval giant kokopu migrating downstream or whitebait migrating upstream.

29 **Upland longjaw galaxias** have been located in one tributary, Landslip Creek, of the Hurunui River upstream of Lake Sumner (NZFFD records). Downstream dispersal of upland longjaw galaxias to the vicinity of the AIC intake is extremely unlikely given the current small population and the presence of Lake Sumner in between the population and the intake. As such the fish screen provisions provide no additional protection for this species.

30 The NZFFD does not hold any records of **lamprey** in the Hurunui River and neither the DoC nor Forest and Bird submissions provide any indication of the location of the lamprey in the river, nor do either cite any survey information to support the submission. In my opinion, lamprey does have the potential to be distributed around the catchment including upstream of the AIC intake. Upstream migration by lamprey is undertaken by adult fish that are too large to pass through the current 5 mm mesh screen on the AIC intake and they are too large to become impinged on the screen due to the water velocity.

31 In the native fish screening guidelines, Charteris (2006) makes no specific references to the fish screen sizes required to prevent juvenile lamprey entering intakes, most likely due to the lack of study on this species. Larval lampreys are small, 11 mm long, and would pass through a 5 mm screen and probably a 3 mm screen when they first hatch. Juvenile lamprey reside buried in fine substrates and may move downstream opportunistically. The directed downstream migration is undertaken by a second juvenile life history phase, the macrophthalmia, that is 10-13 cm long (width unknown) over the autumn and

winter period (March to August, Charteris 2006) and would not be vulnerable to entrainment at irrigation intakes when the abstraction is not operating.

32 The current lack of knowledge regarding lamprey in the Hurunui precludes any further assessment of risk.

33 **Stokell's smelt** enter river mouths in Canterbury to spawn in the tidal lagoon areas. This fish is an estuarine dweller and will not occur at the AIC intake and therefore need not be considered in terms of the design of the AIC intake fish screen.

34 **Longfin eel** occur throughout the Hurunui catchment and have the potential to enter the AIC intake. Downstream migrant longfin eels are large and would not fit through the 5 mm mesh and the low velocities encountered at the intake screen would not lead to impingement. Therefore, longfin adults are not considered at risk to entrainment at the AIC intake. This protects the key downstream migration by spawning females, a key fishery and conservation objective.

35 **Longfin elvers** (juveniles) that migrate upstream would pass through a 5 mm screen and smaller individuals may also pass through a 3 mm screen. Charteris (2006) indicates a 1.5 mm mesh would prevent all elver and glass eel passage. In my opinion, the AIC intake velocity is sufficiently low that elvers could swim away from the intake and continue to move upstream. A key consideration with elvers is that they have a very strong upstream migration urge and will avoid downstream movements during this migration. On this behavioural basis the elvers will avoid entering water intakes such as the AIC intake as it appears to be a downstream flow path that the elvers actively avoid. This will reduce or exclude the AIC intake from having a significant effect on elver and eel migration.

36 The Forest and Bird submission also lists **shortjaw kokopu** as present in the Hurunui River and the submission refers to Docherty (1979) as the information source. Docherty (1979) does not specifically refer to shortjaw kokopu, but rather notes whitebait are present in the lower river (Appendix 1) and refers to all species of whitebait but did not actually sample the whitebait run. In my opinion, the braided river habitat is unsuitable for shortjaw kokopu and it is extremely unlikely that shortjaw kokopu are present in the mainstem of the Hurunui River. The nearest known population of shortjaw kokopu is a small population in Blue Duck Creek (NZFFD), north of Kaikoura. No populations of shortjaw kokopu are known on the east coast of the South Island south of Kaikoura. As with giant kokopu, it is extremely unlikely that a population of shortjaw kokopu exists in the Hurunui River and therefore, in my opinion it is

extremely unlikely that any of the proposed fish screening at the AIC intake will benefit shortjaw kokopu.

37 In summary, the proposed WCO fish screen criteria, as compared to the existing fish screen present at the AIC intake, will have very limited if any impacts on the threatened native fish listed in the DoC and Forest and Bird submissions.

Other Native Fish

38 The Forest and Bird submission cites Docherty (1979) as the source of other native fish records including **banded kokopu**, also unlikely to be present, or restricted to tributaries in the lower reaches. It is important to note that Docherty (1979) undertook no native fish sampling for the report and provides a species of list of native fish that was considered likely to present, but subsequent fisheries surveys (e.g., NZFFD, Glova et al 1985) have not located a number of these species.

39 The distribution of other fish species noted as present in the Forest and Bird submission are not defined. **Bully species** at the AIC intake site are likely to be restricted to upland bully as migratory species are unlikely to penetrate inland to the intake site. **Inanga**, the common whitebait species, will also be restricted to the lower reaches, well downstream of the intake. **Migratory koaro** may be present in low numbers in the Hurunui but survey data to date indicates these are rare in the Amuri area.

40 **Torrentfish** are likely to be present at the intake area as adult individuals that will not pass through a 5 mm screen. The spawning biology of this species is poorly understood and the location of spawning habitat is unknown. Downstream movements of ripe adult fish have been noted and it is likely that spawning occurs in reaches of the river below the AIC intake and as such the vulnerable egg, larval and fry stages of the torrentfish would not be exposed to the AIC intake.

41 **Canterbury galaxias** are likely to be present in the vicinity to the intake. Upland bully and Canterbury galaxias fry would pass through both a 5 mm and 3 mm mesh. Given the growth rates of these species, the fry and juvenile fish are likely to pass through the screen for the first six months of life. Neither of the species is considered threatened and while the localised loss of fry and juveniles may cause a localised decline in the fish populations, it will not, in my opinion, threaten the wider Hurunui River catchment populations.

Summary

42 In summary, the Hurunui River is characterised by a native freshwater fish fauna that is common in braided river systems in Canterbury. Two threatened species, longfin eel and upland longjaw galaxias, are present in the catchment, and a third threatened species, lamprey, may also be present. This freshwater fish fauna whilst including the above threatened species is not, in my opinion, an outstanding native freshwater fish fauna.

Brown trout growth and fish screen requirements

43 No growth rate studies of brown trout are available from the Hurunui River. Hayes (1988a) reported the growth rate of brown trout from Scotts Creek and tributary of Lake Alexandrina in the MacKenzie Basin. Hayes (1988a) found 30 mm brown trout fry emerged from the gravels in September. Growth rates varied and by November fry were 40-50 mm long (growth varied between 1980-1982). At this stage the larger fish are unlikely to pass through a 5 mm mesh. In December fish were 55-70 mm long and none are likely to pass through the 5 mm mesh. Therefore, based on the growth rates reported by Hayes (1988a), the change from a 5 mm to 3 mm mesh would provide additional protection of fry in the first two to three months of life.

44 Bonnett & Docherty (1985) and the Fish and Game WCO application note the key spawning areas are the upper river and its tributaries. Spawning will occur elsewhere in the mainstem of the Hurunui River, but the majority of the key spawning areas are not close to the AIC intake. Therefore the AIC intake with its 5 mm screen represents an additional loss of fry (when compared with a 3 mm screen) when fry disperse downstream rapidly from the upstream spawning sites. Hayes (1988b) noted that many brown trout fry in Scotts Creek did not disperse downstream, with 73% remaining in Scotts Creek after emergence. If similar dispersal occurs in the Hurunui catchment only locally spawned fry and some 24% of fry more widely spawned are likely to move or occur in the vicinity of the intake. The 5 mm screen is highly unlikely to allow 50 mm trout to pass through and therefore the dispersal of brown trout juvenile that are larger than 50 mm in length will not put them at risk of entrainment at the AIC intake.

45 The WCO application seeks maximum approach velocities of 0.12 m/s, which is designed to protect small emerging fry from becoming entrained at intakes and become impinged on the fish screens. Bejakovich (2006) notes water temperature and fish size are the two most significant factors that influence swimming speed in salmonids (and other fish). The approach velocity is based on the fish's sustained swimming speed and can be calculated from:

$$V_a = 0.02(\text{length})^{0.56}$$

46 For brown trout fry 25 mm in length the sustained swimming speed is 0.12 m/s – the fish screen approach velocity sought for the WCO. This sustained swimming speed rises to 0.178 by the time brown trout reach 50 mm in length (Table 2, attached). Given the observed water velocity at the AIC intake was between 0.15 and 0.16 m/s during Dr Burrell's site visit, trout fry using sustained swimming will be able to avoid impingement when they are 45 mm long or longer.

47 Dr Young in his expert evidence provides a detailed description of brown trout growth and their distribution within the Hurunui River catchment. However his evidence is very limited with respect to the growth of young of the year brown trout (i.e., fish less than one year old). The growth of brown trout fry and juveniles in the Hurunui catchment is one of the key factors to determine the difference in effectiveness of the proposed 3 mm screen and the current 5 mm screen at the AIC intake.

48 Dr Young in the summary of his evidence (Section 10), states:

> *"The upper Hurunui consists of an interconnected set of waterways that provide excellent habitat for brown trout. The smaller streams provide spawning and rearing habitat, while the lakes and main river sections provide good habitat for adult trout."*

49 The AIC intake is well downstream from the areas Dr Young has identified as brown trout spawning and rearing habitat. It is, in my opinion, certain that brown trout spawn and rear in other areas of the Hurunui but the AIC intake will not impact on the trout rearing area identified by Dr Young.

50 Trout fry in the Hurunui River may emerge at different dates to that observed in the Scotts Creek study of Hayes (1988a), however as long as growth rates are similar in the two areas then the fry in the Hurunui are only at risk of entrainment at the AIC intake for two months. If all or the majority of spawning required to support the significant trout population in the upper reaches occurs in the upper reaches then there is little risk that the AIC intake with a 5 mm screen will have a significant effect on brown trout recruitment.

51 Based on the evidence submitted by Fish and Game's expert for fish screens, Mr Bekovich, the applicant has only provided technical evidence in support of the fish screen criteria. However, Mr Bekovich's evidence is general in nature and provides no information regarding an existing issue with fish entrainment or stranding associated with existing irrigation schemes that take from the Hurunui River. Clearly, this is a matter of concern to AIC, as altering their existing intake to meet with the fish screen criteria would be costly and may be unnecessary if the existing screen's performance is adequate.

52 As discussed in Mr Williamson's brief of evidence, AIC do not have significant issues with fish stranding at the end of the irrigation season. Furthermore, during the consent renewal process for the AIC scheme in the mid-1990s, the issue of fish entrainment was raised by Fish and Game, but their concerns related to the Waiau River part of the scheme. In his submission on the consent renewal application, Mr Wayne McCallum (on behalf of Fish and Game) stated that *"...the Council remains relatively content with the performance of the fish screens on the Balmoral Irrigation Scheme."* I have inspected the ECan file for AIC's water take, which includes fish screening conditions (consent number CRC951327). There are five compliance monitoring reports for the consent: one from the year 2000, and four from 2005 and 2006. All reports indicate that AIC were fully compliant with consent conditions. Comments by the consents monitoring officers indicate that the screen functions well.

Summary

53 In summary, the proposed fish screen provisions of the WCO application will lead to a limited increase in the protection afforded to brown trout fry. The reduction in mesh size will at best provide additional protection for three months and only if there is brown trout spawning and fry rearing in the vicinity of the AIC intake. The consent monitoring of the present fish screen also demonstrates that the 5 mm screen is effective at maintaining trout exclusion.

Conclusion

54 In summary, it is my opinion that the imposition of the fish screening guidelines as part of the Hurunui WCO would be premature.

55 I unaware of any compelling evidence that the AIC intake, the largest water take on the river, is associated with a significant fish entrainment or fish stranding issue.

56 The native fish fauna of the Hurunui River, and threatened native fish species in particular, are not detrimentally affected by the current AIC intake and fish screen.

57 The brown trout fishery, one reported to be excellent, occurs with the current fish screen at the AIC intake for which there has been no demonstrated fish entrainment.

58 The proposed fish screen requirements of the WCO application would at best provide additional protection for brown trout fry for an additional three months and only be beneficial if large proportions of brown trout spawn and rear in the vicinity of the AIC intake rather than in the upper Hurunui catchment.

RM Allibone

23 March 2009

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Hayes, J.W. 1988a: Mortality and growth of juvenile brown and rainbow trout in a lake inlet nursery stream, New Zealand. New Zealand Journal of Marine and Freshwater Research 22: 169-179.

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TABLES

Table 1: New Zealand Freshwater Fish Database Records for the Hurunui River catchment (downloaded March 15 2009).

Scientific name	Common name	Count
Galaxias paucispondylus	Alpine galaxias	17
Galaxias vulgaris	Canterbury galaxias	21
Salmo trutta	Brown trout	40
Oncorhynchus tshawytscha	Chinook salmon	4
Galaxias prognathus	Upland longjaw galaxias	1
Gobiomorphus breviceps	Upland bully	30
Retropinna retropinna	Common smelt	4
Anguilla dieffenbachii	Longfin eel	12
Cheimarrichthys fosteri	Torrentfish	1
Galaxias brevipinnis	Koaro	24
Gobiomorphus cotidianus	Common bully	1
Stokellia anisodon	Stokell's smelt	1
Aldrichetta forsteri	Yelloweyed mullet	1
No species recorded		16
Galaxias	Galaxiid	3
Anguilla australis	Shortfin eel	9
Anguilla	Unidentified eel	3
Perca fluviatilis	Perch	1
Salmo	Trout	5

Table 2: Brown trout sustained swimming speeds.

Fry length	Sustained swimming speed	Month fry of this size are present (from Hayes 1988a)
25	0.121	August-September
30	0.134	September-October
35	0.146	September-October
40	0.157	October-November
45	0.167	November
50	0.178	December

APPENDIX 1: WHITEBAIT SECTION SCANNED FROM DOCHERTY (1979)

5.5 Whitebait

Juveniles of native fishes of the family Galaxiidae make up the whitebait fishery. The catch is predominantly the inanga (*Galaxias maculatus* with several other species present depending on the locality. The official whitebait season in Canterbury runs from 1 September to 30 November. This normally coincides with peak migration times for the major species.

The adults live in the coastal reaches of the river, spawning in autumn. Eggs are deposited on grasses and other vegetation during high spring tides (McDowall 1968). The next spring tide submerges the eggs which hatch and the larvae are flushed out to sea where they grow and return several months later as whitebait.

Whitebaiting serves both as a recreational and commercial fishery utilised by local people and "weekenders". Over 40 whitebaiters were counted at the Hurunui River mouth during Labour Weekend 1977. Normally catches are not large and the whitebaiter is content to go home with a catch of between 100 and 200 grams.

The whitebait run depends on the river mouth being open to the sea, to allow access for the returning juveniles. The mouth must also remain open so that the spring tides can effectively flood the lagoon margins where the adults spawn in autumn.