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FISHES OF THE TE ARAI RIVER

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ABSTRACT

The distribution of fishes at ten sites in the Te Arai River, a tributary of the lower Waipaoa River, is described and the impact on fishes of water abstraction for the Gisborne city supply is examined. The most widely distributed fish species was Cran's bully *(Gobiomorphus basalis*) which was found at all sites, followed by longfinned eels (*Anguilla dieffenbachii)* at 8 sites and shortfinned eels *(A. australis*) at 5 sites. Common bullies *(Gobiomorphus cotidianus)* were found at two sites and inanga (*Galaxias maculatus),* smelt *(Retropinna retropinna)* and torrent fish *(Cheimarrichthys fosteri*) were found at one site.

Cran's bullies were most numerous in runs and in the tails of pools, where water depth was 25 to 65 cm and current velocity was less than about 25 $cm.s^{-1}$. Densities of eels and Cran's bully were lower above and immediately below the water supply intake than at a third site one kilometre downstream, below the confluences of two small streams where flow is permanent.

1. INTRODUCTION

The Te Arai River is one of few remaining East Coast rivers with unmodified headwater catchments. It supports whitebait and eel fisheries, has high water quality and is sufficiently close to Gisborne to be of significant amenity value. However, much of the headwater, and at times during spells of dry summer weather, the entire flow of the Te Arai River is diverted by the Gisborne City Council for the city water supply. The flow remaining in the stream immediately below the intake is not recorded, but there is a stage recorder 8.5 km downstream at Pykes weir. Further downstream on the lowland plain, water is drawn from 23 intakes for spray irrigation. Often, particularly during summer, there is insufficient water to sustain total demand for irrigation. To address this problem, the East Cape Catchment Board (ECCB) has prepared a draft Water Allocation Plan of the River. However, the plan offers minimal provision for non-consumptive uses for water, and gives scant regard to fishery values and flow requirements of fish. This seems to be because little is known of the fish fauna and, accordingly, associated values have not been recognised. The objectives of this study were to identify the fish species present, to describe their distribution within the river, to identify some habitat preferences for fish and to consider the influence of abstraction on fish distribution.

2. STUDY AREA

The Te Arai River, a tributary of the lower Waipaoa River, drains part of the southern East Cape. The river arises in native forest, then flows through steep erosive pastoral land to an extensive lowland plain, recently developed for horticulture. Upstream of the plain, the river

channel consists of alternating riffle- pool or riffle-run sequences. Riffle substrate is dominated by cobbles and boulders whereas pool substrate is usually sand, gravel or bedrock. At the floodplain the meandering channel consists of long, deep runs entrenched in steep, willow lined, slumping silt banks. Ten sites (Fig. 1) progressing downstream from above the City Council water supply intake to near Manutuke (where the river becomes tidal and flows into the Waipaoa River) were chosen to represent the habitats present in the river. Sites 1 and 2 were in the native forest of the upper catchment. Site 1 was above the intake and site 2 immediately below where, at times, there is no flow. Sites 3 to 7 were permanent flow sites within the area of steep pastoral land. Site 3 was below two small tributaries, site 4 was in a turbid tributary stream draining a small actively eroding valley. Sites 5 to 7 were in the main river, in reaches dominated by riffle-pool sequences and cobble substrate. Sites 8 to 10 were on the lowland plain where the river flowed through deep silty runs.

During the survey, the flow was greater than normal due to recent rainfall but the water remained clear at the upper three sites. The river became discoloured below the 'Site 4' tributary and was quite turbid below Pykes Weir.

3. METHODS

Each site was electrofished between 3/8/87 and 5/8/87 using a pulsed, DC, generator powered electroshocker. The whole channel was electrofished at sites 1 to 3 to determine the impact of the City Council intake but at sites further downstream sampling was qualitative and used only to establish species presence. To estimate within site variation, each of sites 1 to 3 was divided into five, 20m long reaches, measured along one bank. Each reach was thoroughly electrofished once in a downstream direction, a pole seine and dip net were used to capture the fish and total numbers of each species were recorded.

Some major features of the habitat (pool, riffle, run, margin) were noted at sites electrofished and at the upper three sites where the whole river channel was electrofished, depth and current speed (at 0.6 of the depth) were measured, with a wading rod and Pygmy current meter respectively, at places where fish but not eels were found.

4. RESULTS

Seven species of fish were found at ten sites in the Te Arai River (Table 1). Cran's bullies (*Gobimorphus basalis*), longfinned eels (*Anguilla dieffenbachii*) and shortfinned eel (*A. australis*) were the most widely distributed. Whitebait of the inanga (*Galaxias maculatus*) were caught by a whitebait fisherman fishing near Manutuke, one smelt (*Retropinna retropinna)* and two torrent fish (*Cheimarrichthys fosteri*) were found below Pyke's weir, where species diversity was greatest. Common bullies (*G. cotidianus*) and shrimps (*Paratya curvirostris*) were found in the lower reaches of the river near Manutuke. The freshwater crayfish *Paranephrops planifrons* was found in the upper and middle sections of the river.

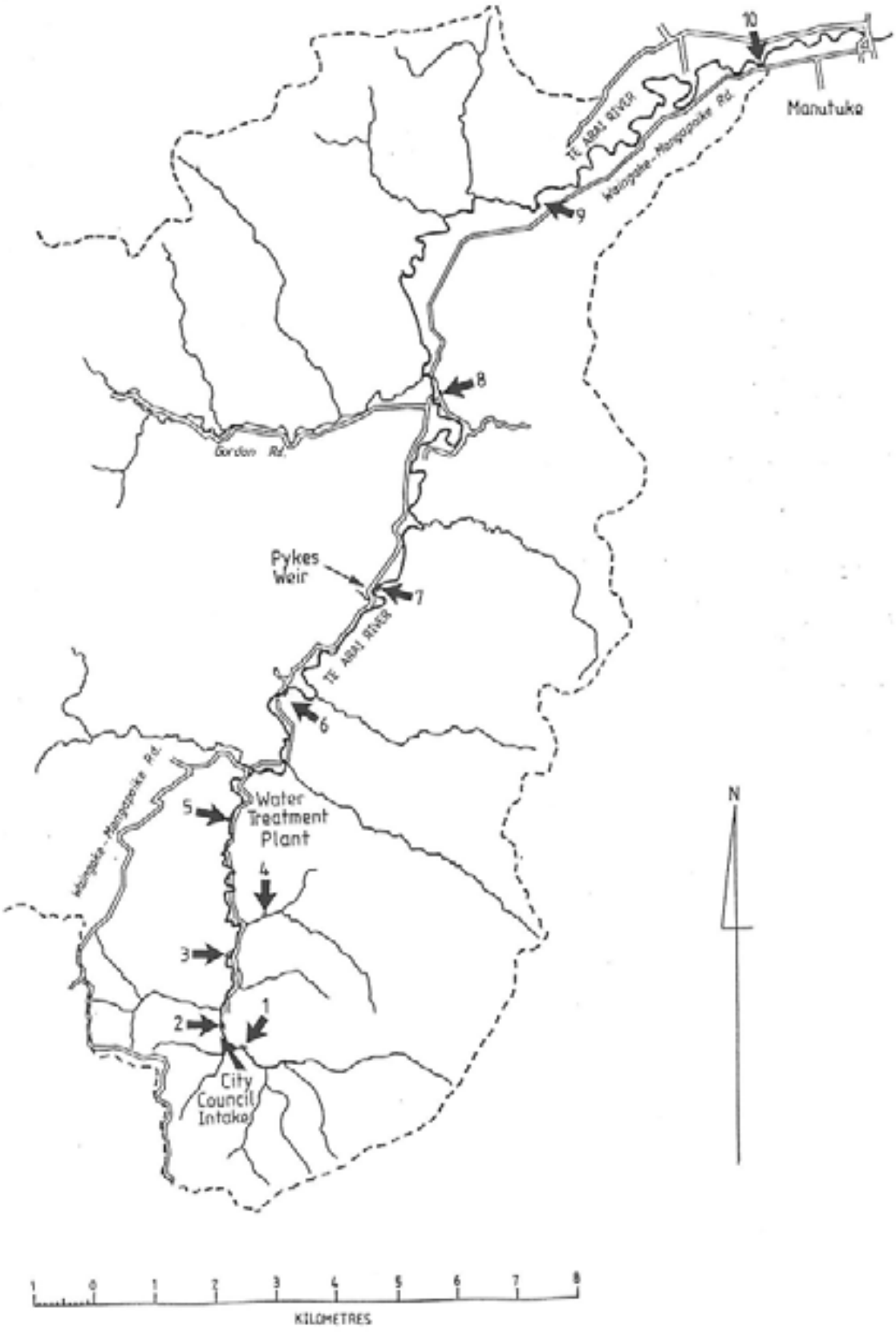

Figure 1. The Te Arai River catchment, sampling sites and places mentioned in the text. The broken line indicates catchment area.

Table 1. Distribution of fishes at ten sites in the Te Arai River. Site numbers correspond to those in Fig. 1. * = present

Site	Cran's Bully	Common Bully	LF Eel	SF Eel	Torrent fish	Inanga	Smelt	Shrimp
1	*		*	*				
2	*		*	*				
3	*		*	*				
4	*		*					
5	*		*					
6	*		*					
7	*		*	*	*		*	
8	*		*					*
9	*	*						*
10	*	*		*		*		*

Densities of Cran's bullies (Table 2) were similar (Newman-Keuls multiple range test; $.2 < p < .5$) above and immediately below the city water supply intake, but were significantly higher ($.01 < p < .025$) further downstream (site 3). Densities of eels were also similar above and below the intake ($p > 5.$) but increased at the downstream site ($.01 < p < .025$).

Large catches of both Cran's bully and eels were taken at sites 5 and 6 but catches declined further downstream. This may have been because of declining abundance or because it was not possible to fish the whole river channel at these lower sites. Bullies and eels might have been more numerous in inaccessible places.

Table 2. Numbers of Cran's bullies and eels (*A. dieffenbachi* and *A. australis*) caught in each of five reaches sampled at three sites in the vicinity of the Gisborne water supply intake. Since sample variance was proportional to the mean, a Log (n+ 1) transformation was used for analysis of variance (Green 1979) and averages are expressed as geometric means (GM) with 95% confidence limits.

	SITE 1 Above Intake			**SITE 2 Immediately Below Intake**			**SITE 3 1 Km Below Intake**		
	Bullies	Eels	Habitat	Bullies	Eels	Habitat	Bullies	Eels	Habitat
	0	0	Riffle	1	1	Pool/run	7	41	Pool
	4	1	Run	10	0	Pool	110	10	Run
	0	0	Riffle	0	2	Riffle/run	5	13	Riffle
	4	2	Pool	14	3	Pool/run	19	6	Riffle
	3	3	Pool/riffle	5	0	Riffle	75	5	Pool/run
GM	1.51	0.89		3.56	0.89		36.68	5.65	
+CL	4.32	1.94		14.78	1.94		165.96	14.36	
-CL	0.53	0.41		0.86	0.41		8.11	2.22	

Analysis of variance

Cran's Bullies: $F = 8.67$ $0.0025 < p < 0.005$
Eels: $F = 5.82$ $0.01 < p < 0.025$

Conclusion: There were significant variation in both bully and eel densities among the three sites.

Newman-Keuls multiple range test

Cran's bullies: Site 1 = Site 2 < Site 3
Eels: Site 1 = Site 2 < Site 3

Cran's bullies were most numerous in runs and in the tails of pools (Table 2), apparently preferring water 25 to 65 cm deep where the current velocity was less than about 25 $cm.s^{-1}$ (Fig.2). Preferred current velocity may be somewhat lower than estimated because of bias associated with location of electroshocked fish. In slow flowing water, stunned bullies tended to settle amongst boulders where they were neither readily seen nor captured in the pole seine net. However, in swifter places, whilst not readily seen, they were more easily captured in the pole seine. Similarly, their preferred depth may be a little deeper than indicated because electroshocked bullies were more easily seen in shallow than deep water.

No attempt was made to quantify depth and current velocity preferences for eels as they were typically associated with cover provided by undercut banks, tangles of debris or cavities amongst boulders. Current velocity in the immediate vicinity of such places would be unlikely to reflect that within the cover. Numbers of other fish species observed were insufficient to identify any habitat preferences.

5. DISCUSSION

The fish fauna of the Te Arai River is dominated by Cran's bully. This species is able to complete its life cycle within the river system (McDowall 1978) and so, unlike the other species found, does not require access to the sea. Consequently, impediments to migration would not preclude habitation upstream by Cran's bullies, whereas Pykes weir and the City Council intake probably obstruct upstream passage of smelt, inanga and possibly common bullies and torrent fish. Eels are stronger upstream migrants and are able to find ways around these obstacles.

Additional species would probably have been encountered if sampling had taken place under low flow conditions in summer, when the lower river could have been sampled more effectively, and if headwater tributaries within the forested catchment could have been sampled. These forested streams are the only places in the Te Arai catchment likely to provide habitat suitable for banded kokopu (Galaxias fasciatus) or koaro (G. brevipinnis). Other species such as redfinned bullies (Gobiomorphus huttoni) and grey mullet (Mugil cephalus) may be present in the lower river, and might be revealed by more effective sampling.

There was significant variation in Cran's bully and eel abundance at sites above and below the City Council intake. Lowest numbers were found directly above and below the intake, possibly because the intake causes significant numbers of bullies to be lost downstream, either to the water treatment plant (where Council staff have observed large numbers

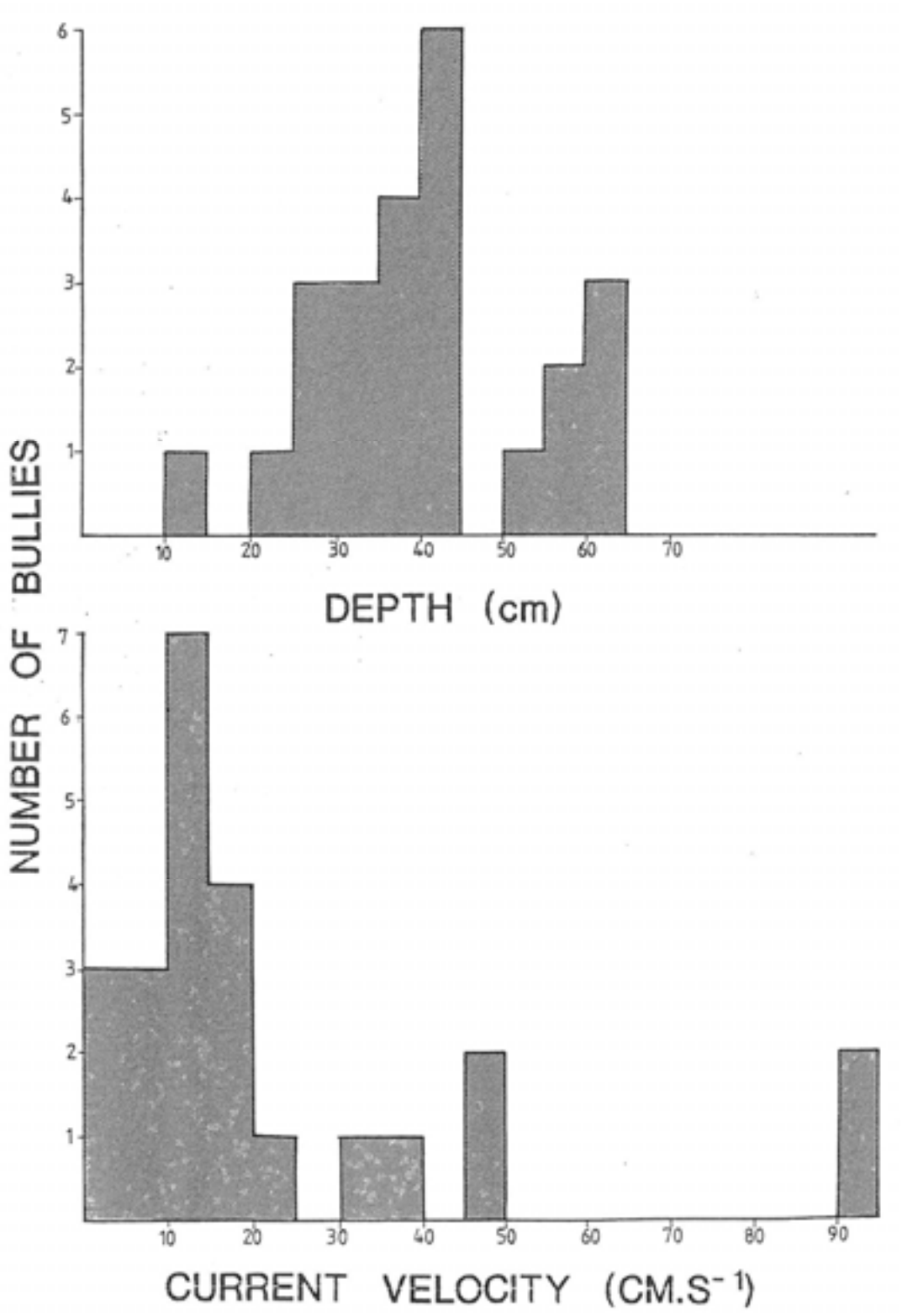

Figure 2. Depth and current speeds (measured at 60% of the depth) at locations where Cran's bullies were found.

of bullies) or to the lower river. The river section immediately below the intake could be colonized from both above and below, but would provide only temporary habitat while the intake did not consume the entire flow. It seems likely that the higher densities observed 1 km downstream were a result of permanent flow and colonization from both upstream and downstream. Reduced numbers of eels were also associated with the intake, presumably for similar reasons, although some eels were clearly able to bypass the structure.

Cran's bully seems to prefer deeper, slow flowing, cobble and bouldery parts of the river whilst eels seek cover which can be found in any part of the channel. These features may enable eels and Cran's bullies to withstand periods of extremely low flow. Species which require swifter flow and live in margin or riffle habitat (e.g. koaro, torrent fish, redfinned bullies, trout) would be less able to withstand low flows.

A minimum flow of 25 $L.s^{-1}$ should be provided below the City Council intake at all times. The minimum drought flow is thought to be 25.6 $L.s^{-1}$ (Draft Water Allocation Plan; Pg.28). In addition, a fish pass should be provided to assist upstream passage past the intake for young eels, galaxids, bullies and torrent fish.

Abstractions in the lower Te Arai River should cease when the flow at Pykes Weir falls below 30 $L.s^{-1}$. This would provide a further 5 $L.s^{-1}$ for irrigation (assuming recommendation 1 above is implemented) as well as substantially increasing flows during dry conditions.

If further understanding of the impacts of abstractions on fisheries of the Te Arai River are required then sampling should be undertaken in late summer when flows are minimal. Particular attention should be given to the lower river and upper headwater tributaries as these areas were not adequately sampled in this study and impacts of abstractions in the lower river remain unknown.

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