

HEAVY METAL TOXICITY
TO RAINBOW TROUT,
SALMO GAIRDNERI RICHARDSON,
DURING EARLY DEVELOPMENT



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HEAVY METAL TOXICITY TO RAINBOW TROUT, SALMO GAIRDNERI
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A THESIS

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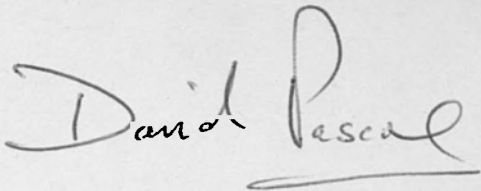
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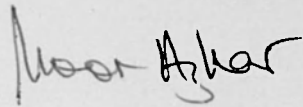
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DECLARATION

We hereby certify that the work submitted in this thesis is the sole result of investigations performed by the author in the Applied Biology Department of UWIST during the period October 1979 to February 1983.

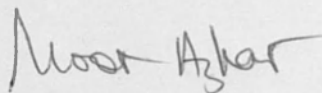


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I hereby declare that the thesis entitled "Heavy metal toxicity to rainbow trout, Salmo gairdneri Richardson, during early development" has not been submitted in candidature for any other degree and is not being concurrently submitted for any other degree.



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Summary

The toxicity of cadmium, copper and zinc to rainbow trout, Salmo gairdneri Richardson, during early development was investigated. In addition the synthesis of cadmium-binding protein by the perfused rainbow trout liver was studied. It was concluded that;

- 1) Cadmium is extremely toxic to rainbow trout during early development. A continuous cadmium exposure during embryonic development resulted in almost complete mortality of eggs at 1.0 mgCd l^{-1} . Some sublethal effects were also observed in hatched alevins.
- 2) Embryonic sensitivity was not uniform throughout egg development. The fertilisation process was particularly sensitive to cadmium exposure. Reductions in the fertilisation of eggs ^{were} obtained as a result of exposure to 1.0 mgCd l^{-1} and higher. The results also indicated that the period of axiation was sensitive to cadmium exposure as shown by a high mortality rate of eggs in continuous exposure tests.
- 3) Embryonic sensitivity to cadmium and zinc differed from sensitivity to copper indicating possible differences in toxic actions between these metals.
- 4) The toxicity of mixtures of cadmium, copper and zinc indicated that the toxicity of these metals to trout eggs and fry could be assessed by the additive toxic unit method to give the total toxicity of the mixture. However sublethal effects and metal uptake studies showed possible departures from additive joint action.
- 5) Post exposure mortalities may result from brief exposure of fish to cadmium even after restoration to clean water. These results highlight the inadequacy of a standard toxicity test in predicting the consequences of brief exposure to a pollutant.

- 6) A cadmium-binding protein (CdBP) of estimated molecular weight 7,200-7,400 was synthesised by the perfused rainbow trout liver. Its synthesis was dependant on perfusion time duration and perfusate cadmium concentration. However it cannot be categorically classified as a metallothionein without further purification.

Introduction and review on cadmium and its toxicity.