Diet overlap between coexisting populations of native blue ducks (*Hymenolaimus malacorhynchos*) and introduced trout (Family: Salmonidae): Assessing the potential for competition.

A thesis

presented in partial fulfilment

of the requirements for the degree

of

Doctor of Philosophy

at

Massey University

by

DALE JEFFERY TOWERS

1996

Abstract

I investigated diet overlap between blue ducks and trout, to assess the possibility that introduced trout (Family: Salmonidae) may be acting as an agent-of-decline on New Zealand's endemic blue ducks (*Hymenolaimus malacorhynchos*). Blue ducks inhabit fast-flowing rivers and streams. Both rainbow (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) were liberated into New Zealand's rivers and streams in the 1870s. Stream macroinvertebrates are consumed by both blue ducks and trout raising the possibility that the two animals may compete for food resources.

The importance of different prey in the diets of trout and blue ducks was assessed both in terms of numbers of prey consumed and prey dry weight. To analyse each predator's diet in terms of prey dry weight, I developed regression equations for commonly eaten macroinvertebrates. These allowed for the estimation of dry weight from prey head width and body length measurements. A power equation, $y = ax^b$ is used to express the relationship. The precision of dry weight estimation varied between taxa ranging between ± 10% and ± 40%. For the majority of taxa, dry weight could be estimated with greatest precision from body length.

The relative abundance of macroinvertebrate prey was measured in trout stomachs and faeces of adult blue ducks collected from Tongariro, Manganuiateao, Ikawetea and Makaroro Rivers in 1991/92. Trichoptera and Ephemeroptera larvae were the most abundant macroinvertebrate prey in the diet of blue ducks inhabiting all rivers. Diptera were also consumed in large numbers by blue ducks on Tongariro and Manganuiateao Rivers but were less important than Trichoptera and Ephemeroptera in terms of dry weight. Prey consumed by blue ducks were also of high importance in the diets of trout in all four rivers. A maximum diet overlap value of 0.69 (Schoener's index) was found using numeric data while a maximum value of 0.89 was found when dry weight data were examined. The highest overlap occurred between blue ducks and trout on

Manganuiateao River. Blue ducks on all four rivers were found to take macroinvertebrates having a smaller mean body length than that occurring on average in the benthos. Trout were found to consume prey having a larger mean body length than that occurring in the benthos. The body length of prey consumed by trout was positively correlated with trout fork-lengths ($r_s = 0.49$ $p < 0.05$). However, the mean body length of prey consumed by small trout (FL < 250mm) was significantly larger than that taken by blue ducks ($T_{199} = -2.74$ $p = 0.007$).

To test the hypothesis that foraging by rainbow trout alters the composition of the aquatic macroinvertebrate community, data were compared from reaches of river above and below waterfalls on Ikawetea and Makaroro Rivers. Discriminant analysis indicated that the macroinvertebrate communities occurring in sections of river free of trout were not consistently dissimilar from those in sections inhabited by trout. However, an enclosure / exclosure experiment conducted in Tongariro River in April, 1993 found that in the absence of rainbow trout the density of Trichoptera, Ephemeroptera and Plecoptera in the benthos significantly ($F_{2, 33} = 3.615$ $p = 0.038$) increased. In addition, in those enclosures containing trout the density of large macroinvertebrates (body length > 7.1 mm) was less than in enclosures free of trout after 6 days.

To examine the response of blue ducks to trout-induced changes in the benthos I conducted an experiment to assess the foraging behaviour of blue ducks in artificial stream channels varying in prey availability. Blue ducks showed a graded response in respect to relative food availability, with a significant correlation between prey density and number of foraging visits to channels ($r_s = 0.738$, $p < 0.05$). In addition a significant correlation was found between the proportion of total foraging time spent in a channel and the proportion of total insect numbers in that channel ($r_s = 0.833$, $p < 0.05$).

For those endeavouring to develop a strategy to ensure the long term survival of this unique waterfowl my research indicates that where trout and blue ducks coexist resource partitioning may result in little interspecific competition occurring and hence competition appears unlikely to be a principal agent-of-decline of blue ducks.

Acknowledgments

As I sit here reflecting on the many hours spent toiling on this project both in the lab and in the field the help and support given freely by many people becomes clear. I wish I could do more to repay these people than merely mention their names, for without them this thesis would never have been completed.

Without doubt, my chief supervisor Dr Clare Veltman deserves my deepest gratitude. Clare always made me strive to produce my very best work, took time to explain and direct, and reassure at those times when doubt entered my mind. Without Clare's help I quite simply would not be where I am today both academically and professionally.

Dr Ian Henderson, my co-supervisor deserves special thanks as he provided great assistance with all aspects of this research. My third supervisor, Dr Murray Williams (DoC) also deserves thanks for he initially helped get this research off the ground and latter provided critical comment on the thesis sections as they became available.

Over the five years taken to complete this work my wife, Frances spent many an hour helping me, dropping me off and picking me up from around the country, proof reading and generally providing support.

A great deal of help was received in the field during the collection of data. A good deal of this assistance related to the capture of trout from the four study rivers. The staff, particularly Ian Maxwell and Glenn Maclean of the Fisheries Division of Turangi Department of Conservation helped with the Tongariro River electrofishing while Wayne Hutchingson of the Wanganui Department of Conservation Office and Mat McDougall of Fish and Game Council assisted in the collection of trout from Manganuiateao River.

Much of my work on Ikawetea and Makaroro Rivers coincided with the blue duck population monitoring conducted by Hawke's Bay Department of Conservation. Pat Bonis and John Adams oversaw much of this monitoring programme and allowed me to accompany

them into the field. This greatly reduced the logistical problems I would have otherwise faced. Pat also provided assistance when I conducted fieldwork at times other than those associated with their monitoring programme.

A very special thanks goes to John Simester and partner Sarah of Staglands. John and Sarah allowed me, a total stranger at the beginning of the experiment described in Chapter Five to build an aviary, park my caravan and freely use their facilities. The two-and-a-bit months spent conducting the experiment were made a lot more bearable by the day-to-day contact with them. I am also grateful to those members of the Ducks Unlimited captive breeding programme who allowed me use of birds in their care while conducting the experiment at Staglands.

The construction of the aviary used in the Stagland experiment was very much a team effort and as such I thank Jens Jorgensen, Jonathan Miles and Paul Barrett for their help. Thanks also goes to Jens for providing invaluable help in the construction of the enclosures used in the field experiment detailed in Chapter Four. Vaughan Keesing and Gary Bramley also deserve thanks for their latter help in the removal of the enclosure material from Tongariro River, which was no easy task.

My parents, who have always had a genuine interest in my work deserve thanks for their support throughout this project. During my work at Staglands my parents lent me a vehicle without which I would have experienced a great deal of logistical difficulty conducting the study.

In the closing stages of this research Kingett Mitchell & Associates have allowed me to make use of company facilities and provided staff time to help in the production of the final thesis.

The majority of financial support for this research was provided by the Department of Conservation in the form of a PhD scholarship. Funding was also received from Ducks Unlimited to help cover costs associated with the building of the aviary described in Chapter Five.

To all those mentioned above and the many others who also provided help and support please accept my sincere thanks.

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