SCIENCE AND RESEARCH INTERNAL REPORT N0.30

CONSERVATION STRATEGY FOR BLUE DUCK 1988 -1992

compiled by

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PREFACE

In April 1988, a seminar on blue duck conservation and management was held at the National Wildlife Centre, Mount Bruce*. This seminar, organised by Wanganui region, Department of Conservation, was attended by representatives from the department's Waikato, Eastern, Wanganui Nelson-Marlborough, West Coast and Canterbury regions and from its Protected Ecosystems and Science and Research directorates at Central Office. Other participants included representatives from Ducks Unlimited, Ornithological Society of New Zealand, Massey University and Otorohanga Zoological Park.

During the seminar, the results of recent research and of a pilot study of the distribution and abundance were presented together with reports on present or planned conservation activities of the Department's various regions and Ducks Unlimited. The overwhelming view of seminar participants was that blue duck needed active management and that its conservation, before it became another of our extremely endangered species, was warranted as a national and regional priority.

This document is the outcome of deliberations at that seminar. It also takes into account extensive consultation subsequent to the seminar. As a result, this conservation strategy is a fully supported document.

The format of the conservation strategy has been dictated by the administrative framework within which the Department of Conservation, the statutory agency responsible for wildlife management, operates. Because management responsibility is devolved to regional units, the approach has been to identify a national conservation objective and then outline ways by which each region can contribute to achieving that objective. A mechanism for maintaining inter-regional liaison is established. Various activities are timetabled, but only for the period It is intended that this conservation strategy should be re-appraised, and activities within it, retimetabled at regular intervals.

This conservation strategy is a working document, and although, over time, it will be subjected to changes in both content and emphasis, it is a statement and outline of intent.

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*Footnote: Proceedings of this seminar have been published as: M. Williams, 1988. Summarised proceedings of a blue duck conservation seminar. Department of Conservation Science and Research Internal Report No. 13

BLUE DUCK -THE REASONS FOR CONCERN

Blue duck is a waterfowl found only in New Zealand, where it is restricted to riverine habitats. It is a particularly ancient species, so much so that it has no close relationship with any other of the world's living waterfowl. Its evolutionary uniqueness is matched by that of its habitat choice; only three other of the world's 142 species of waterfowl live permanently on rivers.

High levels of evolutionary and biological uniqueness are accorded many other of New Zealand's avifauna such as the endangered kokako and kakapo, and the extinct huia.

In pre-European times, it is thought that blue ducks were widespread throughout both main islands of New Zealand although apparently not in Northland, nor on Stewart or Great Barrier Islands or other offshore islands. Early naturalists, writing in the Transactions of the New Zealand Institute refer to the duck's presence in alpine rivers and tarns, in 'mountain torrents' draining axial ranges in both islands, as well as on some (although few) lowland rivers.

Today, the species has greatly contracted both in numbers and range. Large sections of New Zealand no longer support the species where formerly it was common e.g. Coromandel, Waikato, Taranaki, lower Wanganui, Manawatu-Horowhenua and Wairarapa. And only tiny relict populations now exist in Hawkes Bay, Canterbury and Otago.

The most recent publication of blue duck distribution is contained within the OSNZ Atlas of bird distribution in New Zealand (1985). This highlights the species restricted range, especially in the North Island. On the basis of this distribution, Bell (1986) (The conservation status of New Zealand wildlife, N.Z. Wildlife Service Occasional Publication No.12) assigned blue duck the conservation status of 'threatened' and noted that many populations were declining.

Closer inspection of published, and more-recently collected distribution data reveals that the distribution pattern presented as presence or absence of birds in each 10,000 yd grid square of the national grid (as within the OSNZ Atlas) presents a highly distorted and erroneous impression. In virtually no grid square are birds uniformly or widely distributed over the available habitat. Where major watersheds contain blue duck, this is usually only in some headwaters and rarely in contiguous ones. The distribution is highly discontinuous.

In addition, populations appear isolated from each other; there are apparently barriers of alienated habitat preventing downstream dispersal and integration between populations. This is further compounded by each population being small in size, often less than 10 pairs; indeed there are only two populations known in the North Island where the number of interacting breeding pairs exceeds 30!

Discontinuity of distribution and small size of population isolates are classic symptoms of species in an advanced state of decline. And it is for precisely these reasons that other well-known species such as North Island Kokako are classified as 'endangered'.

For blue duck the process of population fragmentation and reduction is now so advanced in the North Island as to be directly comparable with kokako* and to warrant the species being designated 'endangered' there.

Despite a wider distribution in the South Island, the presence of relict populations in Canterbury (Peel Forest, Arthur's Pass), Otago (Catlins) and Southland (Hauroko, Monowai) indicates the same process is well under way there also.

Blue ducks are long-lived, many birds living in excess of 10 years. Many of the present population isolates can be expected to linger several years before becoming extinct. A short breathing space is provided. During this time a concerted conservation strategy can be developed, tested and while a modest pool of birds exists upon which to draw for conservation purposes and before the species reaches a critical endangered state nationally.

This document outlines a conservation strategy.

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*Footnote: The OSNZ Atlas records kokako in 74 of 1614 North Island grid squares and blue duck in 80.

NATIONAL CONSERVATION OBJECTIVE

"To arrest the decline in numbers and range of blue duck nationally by
(i) maintaining and enhancing existing populations
(ii) establishing new viable populations."

COMPONENTS TO ACHIEVE NATIONAL OBJECTIVE

The following are the components which, collectively, provide the management and research direction to achieving the national objective.

1. Determine the present status and distribution of blue ducks nationally.

Explanation:
This activity seeks to provide the base-line information against which results of management activities may be measured.

2. Monitor representative populations regionally according to a nationally-agreed timetable and technique.

Explanation:
It is not possible to monitor population trends over wide areas. By selecting 3 populations of differing size and security in each region and surveying these twice-annually according to a standard technique, the trend over time of each region's blue duck population can be efficiently monitored.

3. Protect, by whatever means, the existing values of riverine ecosystems in which blue duck occur or could occur and enhance these where possible.

Explanation:
The protection and enhancement of existing or potential habitat is the basis of blue duck conservation and in many areas may be the only management activity necessary to achieve long-term population stability.

4. Identify locations at which new viable populations could be established and attempt that establishment.

Explanation:
The re-introduction of birds to former habitats or into areas outside their present or historic range requires critical assessments of watersheds, the testing of re-establishment procedures, and in some instances the rehabilitation of habitats.

5. Conduct research aimed at identifying methods of population and habitat enhancement and population establishment, and apply the results of that research.

Explanation:
Research projects on a range of identified topics (see P.13) serve to help evaluate management activities and suggest potential management approaches.

6. Establish a 'blue duck management liaison group' to co-ordinate and focus regional management activities and research, and to promote implementation of the blue duck conservation strategy.

Explanation:
A group of people from within and outside Department of Conservation who facilitate conservation activity on this species and who, collectively, provide a common focus for all parties involved in blue duck management.

MANAGEMENT PROCEDURES

Detailed below are a series of procedures and guidelines whereby the principal components for achieving the national objective can be enacted. They are not exhaustive and managers are encouraged to introduce other complementary and novel procedures.

Purpose: - to determine the distribution of the blue duck.

Key Personnel:

- at DOC regional and district level (as appropriate) one officer is designated responsible for survey implementation and data receipt.

- at Central Office (Science and Research Directorate) one officer is designated responsible for maintaining the computer-based national distribution database.

Data Collection:

- devise recording scheme suitable for field and office use (see Appendix 1 for a model field card).

- data required are
  (i) date (as day/month/year)
  (ii) location (as NZMS 1 map no and grid ref.)
  (iii) catchment (name of principal river and tributary as appropriate)
  (iv) number seen (as adults and/or young)
  (v) notes (e.g. behaviour, nest, eggs etc.)

Data Management:

- field reports (cards) retained on regional/district file

- data added to national database via DOCNET (if not able to be accessed, send to responsible officer at Science and Research, C.O.).

Supporting Activities:

- local publicity via newspaper, radio etc to solicit public reports

- contact with local interest groups to solicit reports.

- record cards or information on scheme placed in tramping huts in appropriate areas.

Comments:

- timing of surveys and survey techniques, see Appendix 2

- particular emphasis should be given to those watersheds which appear as gaps in the known distribution

-set target date for completion of survey at level (not later than April 1992).

2. POPULATION MONITORING

Purpose

- to follow short-term fluctuations and long-term trends in blue duck populations of differing size in habitats of differing quality. Results are indicative of blue duck population trends throughout the region

Site Selection:

-Ideally this should involve at least 3 populations per region as follows:

(a) part of a large (12+ pairs) population in a secure and relatively unmodified habitat,

(b) a population of 6-12 pairs within an extensive watershed but where parts of the watershed apparently no longer support blueduck,

(c) a population isolate (3-5 pairs) in a restricted locality and without contact with other populations,

- study area able to be traversed in single day.

[Not all regions are likely to have populations in each size class. Select at least 3 sites to encompass all population sizes within region even if this results in duplication of one or more of the above categories.]

Key Personnel:

- at DOC regional office, one officer responsible for survey co-ordination. Regional advisory scientist, where present, to provide advice on methodology

- at DOC district level, one officer responsible for organising and conducting monitoring surveys and producing written biennial summary of results.

Data Collection:

- prepare field maps based on most recent aerial photographs (e.g. from Department of Survey and Land Information)

- record
(i) date (as day/month/year) and weather
(ii) plot location of sighting on map
(iii) note number birds seen, age (adult or chick), and sex (if bird whistles).
(iv) behaviour and other items of note, location of faecal sign
(v) conspicuous features of habitat (so as to monitor any change in habitat quality over time).

Data Management:

- field maps retained at district/regional office

- biennial summary produced for within-region and between-region circulation and for perusal by Blue Duck Management Liaison Group.

Supporting Activities:

- release of biennial summary to press and radio with supporting information.

Comments:

- timing of surveys and survey techniques, see Appendix 2

- banding of some resident pairs is worthwhile. Techniques described in Appendix 3.

-if access to monitoring area permits, there is considerable value in repeating survey on consecutive days but at different times of day e.g. afternoon day 1, morning day 2

- target date for selection of monitoring areas June 1989

- duration of activity envisaged as 10 years but should be included within proposed 1992 review. Long-term monitoring for such a long-lived species.

[This activity lends itself to the inclusion of, or delegation to, interested and enthusiastic people not within employ. Examples are members of Ornithological Society of New Zealand Royal Forest & Bird Protection Society, Ducks Unlimited, tramping clubs. Such outside participation should be encouraged.]

3. HABITAT PROTECTION AND ENHANCEMENT

Purpose:

- to maintain existing quality of present blue duck habitat on both public and private land and to improve habitat quality where practicable. Similar action should be directed towards waterways considered potential habitat for blue duck.

Personnel:

- all Department of Conservation Regional and District Planning Officers, District Conservators.

Principal Activities:

1. Invoke, as and when necessary, any of the range of statutory, planning or practical activities which and maintain water quality, water quantity and continuity of flow as well as maintaining integrity of existing riverbed. E.g. water conservation orders, district scheme zoning, water right hearings, pollution and mining controls, covenants etc.

2. Protection or re-establishment of riparian woodlands by variety of existing land protection procedures and by concerted advocacy.

   An ongoing activity as part of general conservation of natural values. However, specific rivers of high existing or potential value could be targeted regionally and, for example, re-establishment and/or protection of riparian woodland systematically pursued.

4. POPULATION ESTABLISHMENT AND ENHANCEMENT

Purpose: - to attempt enhancement of some existing population isolates and to attempt the establishment of new populations.

4A. Identifying Populations for Enhancement and Unoccupied Habitat

During the 1988-1992 period no active enhancement or establishment is envisaged. Instead, this time period should be devoted to necessary preparatory work as suggested below.

Key Personnel:

- At regional/district level, officers designated responsible for blue duck surveys and related blue duck management activities,

- Convenor, Blue Duck captive-breeding group.

Principal Activities:

1. Identify existing small populations suitable for enhancement (criteria see Appendix 4), or habitat suitable for population establishment (criteria see Appendix 5).

2. Identify a source of birds for release [wild birds may be translocated from an existing healthy population within the region, or captive-reared birds may be released].

3. Prepare a local enhancement or establishment plan in which all planned activities are chronicled and costed (see Appendix 6 for guidelines). To provide inter-regional liaison, such plans should be available for perusal by Blue Duck Management Liaison Group.

Comments:

1. Identity of populations suitable for enhancement or localities suitable for population establishment are likely to be derived from region/district - wide surveys of blue duck distribution and status.

2. Wild birds being considered for translocation should be from a large, viable population that is subjected to regular monitoring aside from those which are part of the regional monitoring scheme.

3. Captive-reared birds being considered for release should come from breeders participating in the captive-breeding scheme (see 4B below) and, where possible, be progeny of birds derived from within or adjacent to the watershed in which the birds are to be released.

4B. Captive Breeding Programme

There is a need for 30 captive-reared birds to be available annually by 1992 to fuel initial programmes.

Key Personnel:

A 'Captive Breeding Group' comprising:-

(i) three members of Ducks Unlimited, one of whom shall be convenor and shall

be the DU nominee on the Blue Duck Management Liaison Group, and one of whom shall be a participating breeder, and

(ii) Conservation Officer (Protected and Endangered Species), PES Directorate, Dept of Conservation, Central Office.

Principal Activities:

The Captive Breeding Group shall

(i) produce a captive-breeding plan to the satisfaction of the Blue Duck Management Liaison Group in which aims of the programme and captive management procedures are outlined,

(ii) identify availability and/or need for breeding stock

(iii) select and supply participating breeders,

(iv) maintain a register which records the origin or parentage and breeding performance of all birds in captivity,

(v) In consultation with the Blue Duck Management Liaison Group initiate releases of 1990 and 1991 progeny onto a selected river to determine survival of captive-reared birds in the wild.

(vi) through the Blue Duck Management Liaison Group, maintain a liaison with all relevant regional offices of DOC and, upon request, arrange for birds to be supplied for enhancement/establishment programmes.

Timetable:

- Captive Breeding Group established immediately at discretion of Ducks Unlimited.

- Captive breeding plan prepared by June 1989 and participating breeders supplied with birds by that date.

- Trial release plan prepared by June 1990.

Comments:

-funding of the activities of the Captive Breeding Group and of the costs incurred by participating breeders shall be by way of sponsorship arranged through Ducks Unlimited.

5. Public Education

Purpose:

- to promote public awareness of conservation activities on blue duck and to elicit public support.

Key Personnel:

- Regional Advisory and Extension Officers, Information Officer (Central Office), District Conservators, District staff, members of Ducks Unlimited and other supportive interest groups.

Principal Initiatives:

1. Nationally-available pamphlet giving brief details of uniqueness, status, biology and conservation plans for blue duck and soliciting public reports of sightings. To be prepared and distributed by DOC Science and Research Directorate, Central Office.

2. District and/or regionally-prepared articles or press releases provided to news media at regular intervals. This is likely to be most effective at local level.

3. Encouragement for district/regional staff to address meetings on subject of blue duck. This would be facilitated by each region preparing a script with supporting slides, and also having available copies of Survival Anglia's video 'White water, blue duck'.

4. Preparation of static-display material highlighting local work for display locally. Prepared by regional or district offices.

5. Publication of static display material by Ducks Unlimited to highlight the conservation strategy and their role in it

6. Publication of a high quality book for national distribution and sale. Publication to include distribution and biological information and numerous high quality photographs, and to be the principal public presentation of the conservation strategy (in a rewritten form!).

Timetable:

- National pamphlet -published by Dec 1988.
- Regional static display material -prepared by June 1989.
- Regional package -prepared by June 1989.
- Book - for publication 1990.

Comments:

General approach is one of exploiting any opportunities for publicity.

All costings to be budgeted at regional/local level.

6. RESEARCH NEEDS

Purpose:

- to undertake studies and provide services which assist the management of blue duck nationally.

Key Personnel:

Assistant Director (Research), designated Science and Research staff (Central Office), Regional advisory scientists.

Research Topics/Services:

In order of priority

1. Develop and manage within the Science and Research Directorate, Central Office, a computer-based record scheme for the national distribution of blue duck.

   [A central database able to be accessed via from all regional and district offices and which allows records to be added and information retrieved locally.]

2. Determine the genetic structure of 'representative' blue duck populations.

   [Recent research on Manganui-a-te-ao population has highlighted extensive inbreeding within a segment of the population. Is this typical of all blue duck populations or is it a result of population isolation?]

3. Determine, by biochemical means, the nature and extent of blue duck dispersal between adjacent populations.

   [There is, at present, no evidence of blue duck dispersing overland between populations, but methods so far used, e.g. banding, have little chance of detecting such movement. Biochemical examination of birds in adjacent populations should indicate whether such inter-population movement takes place.]

4. Identify factors that have caused the demise of blue ducks in catchments from which they have recently disappeared.

   [Restoration of populations demands that factors which have caused their initial demise be identified and corrected. This study should include a comparison of the in-stream characteristics of present and recent blue duck habitat so as to provide, hopefully, a method for evaluating the potential of presently unpopulated rivers.]

5. Long-term study of biology and population dynamics of blue duck on Manganui-a-te-ao River.

[Present study to continue with same objectives for a further 5-year period so as to cover lifetime of all original (1980) study birds. Subject to review in 1992.]

6. Population dynamics and habitat use of blue duck in a pristine South Island habitat.

   [All existing management ideas and perceptions of blue duck habitat use are based on a single North Island study on a river which is atypical of most blue duck habitat in the South Island. A study with similar objectives to that on Manganui-a-te-ao requested.]

7. Determine ways of increasing the productivity of some accessible blue duck populations.

   [Experimentally test a variety of management techniques, e.g. egg removal, re-nesting, removal of non-productive pairs etc which attempt to increase the reproductive output of wild birds.]

8. Assess the impact on blue duck population densities of trout as competitors for invertebrate prey.

Timetable:

Topic 1 is an existing hobby activity that could be immediately upgraded to the status of an official task.
Topics 2 and 3 involve limited field and analytical effort and are requested for implementation by October 1988 and completion by June 1990.
Topic 4 involves a major commitment of manpower and funds and should involve someone with skills in stream ecology. Parts of the project are suitable as university student research topics.
Topic 5 is an existing project
Topic 6 could perhaps be initiated either on contract or from within existing manpower resources of either Southern or West Coast regions.
Topic 7 viewed as appropriate for implementation by regional management staff by breeding season in association with regional advisory scientists.
Topic 8 is a potential university research task.

7. Blue Duck Management Liaison Group

Purpose

- to provide inter-regional co-ordination in the implementation of the blue duck conservation strategy, and to promote the conservation of the species.

Composition:

1. Senior Conservation Officer (Flora and Fauna), or his/her nominee from each DOC region in which blue duck reside. (In this instance, from all regions except Northern.)

2. Senior Conservation Officer (Endangered Species), Central Off ice.

3. Assistant Director (Research), Central Office, or his nominee.

4. A nominee from Ducks Unlimited (NZ) Inc. (should be convenor of captive breeding group).

5. A nominee from Royal Forest and Bird Protection Society.

6. An independent scientist with present or past research experience with blue duck -(for the first 4-year period, Dr Clare Veltman, Massey University).

Funding:

All meetings of this group shall be funded by participating organisations, and departmental directorates and regions unless corporate sponsorship is subsequently arranged.

Activities:

1. To meet annually (first in June 1989) to review regional and national progress and plans for implementing the conservation strategy for blue duck.

2. To promote and co-ordinate the implementation of the conservation strategy and to take or recommend whatever national or regional initiatives it so decides to ensure the implementation of the conservation strategy and public awareness of it.

3. In mid-1992 to convene a meeting of all parties involved in blue duck research and management for the purposes of reviewing and updating the conservation strategy.

4. Following the 1992 review, to be responsible for the preparation of a revised conservation strategy for blue duck for the period 1992-1997.

APPENDIX 1

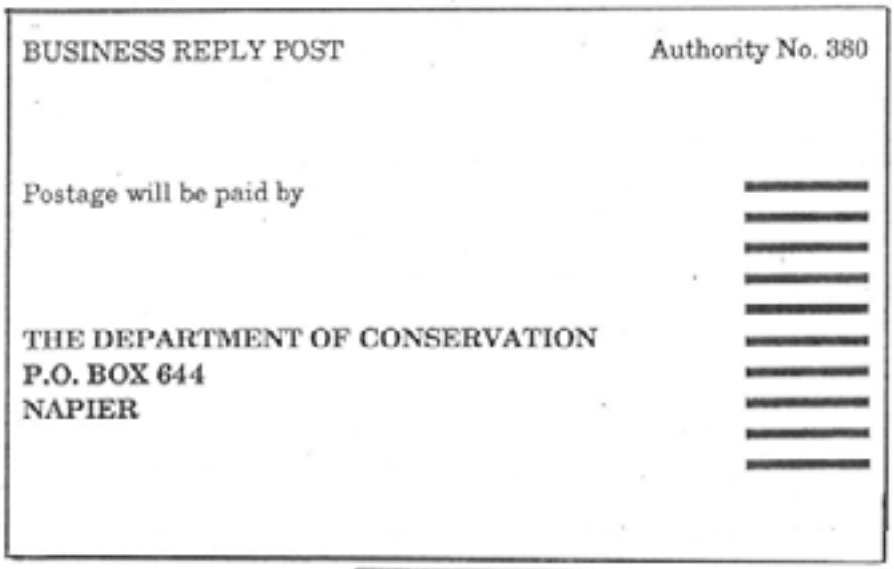
FIELD AND OFFICE RECORD CARD

An excellent example of a field/office card is illustrated below. This card is presently in use in Napier District. In addition to the essential information, which is

- date
- location
- number seen
- observer's name and address

this card seeks information on river characteristics.

An innovative feature of the card is that it is 'reply paid'.



BUSINESS REPLY POST Authority No. 380

Postage will be paid by

THE DEPARTMENT OF CONSERVATION
P.O. BOX 644
NAPIER

BLUE DUCK SURVEY CARD

DATE:			RIVER SYSTEM:		
TIME: am/pm			TRIBUTARY:		
GRID REFERENCE:			MAP SERIES & No.:		
No. OF ADULTS SEEN:			No. OF JUVENILES SEEN:		
River Flow	V. Low	Low	Normal	High	V. High
Water Clarity	Clear	2	3	4	V. Murky
OBSERVERS NAME:					
ADDRESS:					
COMMENTS:					

This Card is Reply Paid — Please post it at your earliest convenience.

Thank You for Your Co-operation — Department of Conservation.

APPENDIX 2

TIMING AND TECHNIQUE OF SURVEYS

Seasonal Timing:

Pre-breeding surveys will identify location and number of pairs and thus give a good idea of the size and distribution of the breeding population. Unestablished birds are most likely to be encountered as single birds and provided the survey is done prior to females commencing incubation, these single birds should not be confused with waiting males. Most appropriate time is August (may be a little later in some South Island locations where known breeding season doesn't commence until October/November).

Breeding season surveys will identify breeding success by highlighting number of pairs with and without ducklings, and the average size of surviving broods. Most appropriate time is mid November - early December (for North Island) but perhaps later in South Island.

Post-breeding surveys seek to provide an estimate of entire population. Adult birds, upon demise of their breeding attempt or after fledging of their young, enter their annual moult and are very inconspicuous during this 6-8 week period. Juveniles are actively dispersing at same time as adults are moulting. Because of the frequent occurrence of groups of juveniles, surveys at this time are not appropriate for identifying territorial pairs as a specific category. Most appropriate time is March-April.

Time of Day:

Blue duck have well defined activity cycles which affect their conspicuousness. From dawn until approximately 10 am (later in winter) birds are usually active on the river, feeding or moving about. The late morning to late afternoon period is spent mostly at rest and, on many waterways, the birds are hidden from view at this time. From late afternoon (i.e. after about 4pm) birds commence feeding again and are active until dark. There are some localities within Urewera National Park) where birds are almost nocturnal in habit, being active on the river at dusk and for the first 2-3 hours of darkness. A further brief period of activity coincides with dawn. They are only rarely encountered on the river in daylight.

Survey Techniques

Three methods of survey have been attempted in the past:

(i) walking small streams or tributaries to locate blue ducks or their sign,

(ii) floating down larger rivers on tubes or in small rafts to locate birds,

(iii) flying above the river at 20-30 knots in a helicopter (at about 80-100 feet) to locate birds.

Walking of streams is appropriate only in rivers or streams where it is easy to cross at almost any point and which are not more than 20 m wide on average. Such surveys are best done by two people together and, depending on the terrain and the aims of the survey, a well-trained dog is a very useful addition. Faecal sign is a conspicuous indicator of blue duck presence (see Williams 1979, Notornis 26: 306-7) and should be looked for on the tops of prominent rocks in or at the edge of the water. Faecal sign is often concentrated at stream confluences and particular attention should be paid to these locations.

River floating is appropriate for rivers with sufficient flow and depth to allow relatively incident-free tubing or rafting. The technique suffers from the fact that much time and care must be given to manoeuvre in the current. As a result it is relatively easy to slip past a blue duck standing quietly on a river bank. In riffles, places where ducks do most of their feeding and where the surveyors must exercise most personal care, ducks are especially easy to overlook. However, in large rivers where walking is not a comfortable or safe option, river floating is the only realistic survey technique.

For reasons of safety, a survey team floating or rafting should not be less than 4 persons.

Helicopter surveys were conducted on the Motu River with some success. Virtually all birds previously identified during rafting surveys were located from a helicopter. The birds responded to the helicopter by hopping off any rock into the water and watching the aircraft from the safety of flowing water. It is best to calibrate this technique by initially covering some section of river where the number of resident blue duck is known.

Key Personnel:

Stream walking:	Murray Williams, DOC (Science and Research), Wellington.
River floating:	Paul Jansen, DOC (Eastern), Rotorua. Bryan Williams, DOC (Taranaki), New Plymouth Errol Cudby, DOC (Waikato), Turangi
Helicopter survey:	Tony Roxburgh, DOC (Waikato), Hamilton

APPENDIX 3

CAPTURE AND BANDING TECHNIQUES

Capture:

Blue ducks behave in a number of ways than can be exploited when attempting to capture them. These are:

a) they rarely fly beyond the river channel;
b) they seldom fly more than 10-15 ft above the water;
c) their principal means of escape when disturbed is to float down river;
d) adults and young remain as a tight bunch when disturbed or floating down river;
e) adults are flightless for about 6 weeks following their annual breeding attempt.

The general capture technique is to stretch nets across all or part of the river and push birds down river into them. Nets are of 4 inch mesh, black in colour and of light but strong gauge. Standard mist nets are too light to retain all flying birds or those held in nets in the water.

The setting up of the net is illustrated below. When catching flightless adults or adults with flightless young, only a single net secured below the water and rising about 1-1 ½ m above the river surface is required. The birds will simply float into the net when gently pushed.

To catch flighted adults it is best to set at least one further net above the river-level net in case the birds fly. Every care should be taken to push flighted adults gently down river and not cause them to fly -it's much easier and more successful to catch floating birds.

An alternative capture technique appropriate for small streams or tributaries is to spotlight the birds on very dark nights and capture them in handnets. Strong spotlights are necessary to dazzle the birds.

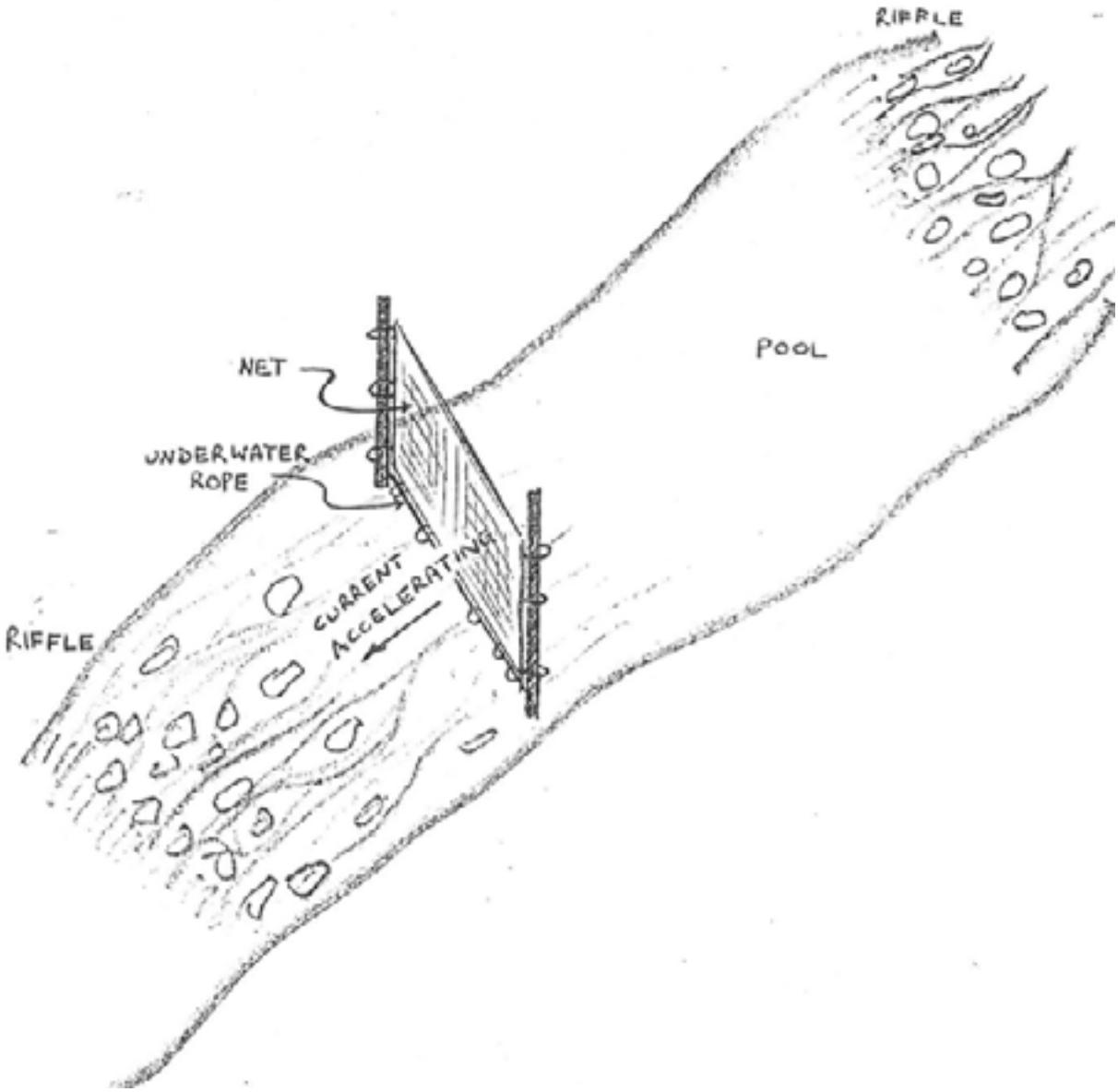
Key Personnel:

The following have had extensive experience capturing blue ducks

Bryan Williams, DOC (Taranaki), New Plymouth
Paul Jansen, DOC (Eastern), Rotorua
Murray Williams, DOC (Science & Research), Wellington

BANDING

All bird banding is conducted under permit, issued by the Director-General, Department of Conservation. All banding programmes must be initially approved by the Banding Officer, DOC (Science & Research), Wellington, from whom all banding supplies may be obtained and to whom all banding records must be sent. The Banding Officer will also advise on banding techniques, provide colour-banding advice and, if necessary, arrange training.



APPENDIX 4

CRITERIA FOR POPULATION ENHANCEMENT

1. Existing population contains not less than three and not more than 10 territorial pairs.

2. Existing pairs are dispersed at low density, i.e. gaps of 6-10 pools/riffle systems exist between known ranges of some adjacent pairs.

3. Apparently suitable habitat occurs above or below range of existing pairs.

4. Other blue duck populations occur or could be established in adjacent catchments/watersheds

5. The total habitat to which birds have unimpeded access has the potential to hold at least 20 territorial pairs. On present knowledge, this translates to 15-20 km of continuous stream habitat including main stem and tributaries.

6. Some habitat protection is possible.

APPENDIX 5

CRITERIA FOR CHOOSING SITE FOR POPULATION ESTABLISHMENT

1. Habitat subjectively appears suitable for blue duck. (Any assessment of potential habitat should be based on a comparison with existing habitat. The species diversity and numbers of stream invertebrates should be of similar orders of magnitude, there should be extensive, preferably continuous, tracts of riparian woodland and there should be evidence of streambed stability.)

2. Locality lies within the known historic range of blue duck.

3. The total habitat to which birds have unimpeded access has the potential to hold at least 20 territorial pairs. On present knowledge this translates to 15-20 km of continuous stream habitat including main stem and tributaries.

4. Habitat is secure from degradation.

5. Other blue duck populations occur, or could be established in adjacent catchments/watersheds.

APPENDIX 6

SOME SUGGESTIONS FOR THE CONTENT OF LOCAL POPULATION ENHANCEMENT OR ESTABLISHMENT PLANS

The required format of local 'project plans' will undoubtedly vary from region to region. However, in order to guide the process by which an enhancement or establishment activity is conceived and enacted, the following topics should be covered somewhere in the plan.

1. Reasons for the choice of site and activity
   Committing these to paper will help crystallise your own thinking and will identify the bases upon which your many choices have been made.

2. Source(s) of birds
   If captive, identify the original genetic origin of the progeny. If they are wild birds being translocated, identify the locality of the source population(s), state why you have chosen these populations as the source, and identify how you intend to monitor the effect of these removals on the source population.

3. The Release
   - how many birds will be released
   - at what time(s) of the year will the be made
   - over how many years will be release programme run
   - what is the method of release

4. Assessment of release
   - how will you follow the birds upon release
   - how frequently will you monitor the birds after release
   - for how long after release will you follow the birds
   - what criteria will you use to evaluate success or failure of (each) release

5. Associated activities
   Do you plan any associated habitat enhancement work, e.g. predator control, fencing of riparian woodland etc. If so, identify nature and extent of these activities.

6. Schedule of tasks (= work plan)

   A precise schedule of tasks, identifying timing of task and who is responsible will ensure a smooth operation.

7. Budget

Overall, enhancement/establishment plans should be brief and to the point. They are there to act as a simple yet precise guide for the intended activity, to ensure that everyone knows their specific tasks beforehand, and, as a result of prior consultation, to ensure maximum success for the conservation activity.

APPENDIX 7

BIOLOGY OF BLUE DUCK

New Zealand's long isolation from other land masses has allowed the evolution and survival of unique forms of such as kiwi and moa, kakapo, kokako and huia to name but a few. To this list can be added blue duck. This bird is in every way unique and has no close relative anywhere in the duck world. Scientific opinion is that blue ducks arose at a very early stage in the evolution of ducks and its subsequent isolation in New Zealand meant that it became well separated from the stock that evolved into the great diversity of duck forms the world now supports. Its antiquity is evidenced by numerous anatomical features and by some aspects of its behaviour. For example, the protein composition of its feathers is unique and unlike those of other dabbling ducks, all of which tend to be similar. The blue duck lacks a wing speculum (the iridescent coloured patch on the inner wing feathers), and has a black edging on the innermost secondary wing feathers - both unique features amongst the duck family (Anatini). Most ducks have elaborate courtship displays; the blue duck's is very simple as are its displays in other contexts.

PROBLEMS OF RIVER LIFE

Some of the blue duck's uniqueness of behaviour is shaped by the habitat in which it lives. Rivers are a difficult habitat in which to live, feed and rear young, so much so that only three other species of ducks worldwide live permanently on rivers; one each in South America, South Africa and New Guinea. Although ducks like mallard and grey are often seen on rivers, they move widely in search of food and most females rear their young on static or very slow flowing waters. In contrast the blue duck feeds only in the river, mostly amongst cascading white water in riffles, and raises its young in the face of a current which, at any moment, can sweep a duckling rapidly down river. As a consequence, blue ducks are strongly territorial, each pair vigorously defending a section of river throughout the year, and the male is an equal participant in the raising of the brood. The necessity to secure a permanent and exclusive feeding and breeding area also shapes the behaviour of newly-flying young birds. Within weeks of first attaining the power of flight, the juveniles are actively seeking an unoccupied section of river. Many try to force their way in between territories of established pairs, and some of the very bold actively challenge established adults and attempt to displace them. Throughout late summer and autumn, the juveniles range up and down the river in search of living space; few it seems are successful for most of the young are never seen again.

A RESTRICTED DIET

The hard-fought ownership of stretch of river does not necessarily provide blue duck with a gross abundance and diversity of food. Indeed the range of foods so far identified is restricted to freshwater invertebrates, principally the larvae of caddis fly, mayfly and stone fly. Freshwater snails and midge larvae are also eaten, often amidst mouthfuls of filamentous algae; whether blue duck can digest and obtain nutrient from algae has yet to be determined. Most feeding seems to take place in riffles, although seldom in the midst of turbulent white water. The birds are adept at exploiting to advantage the vagaries of water flow over and around rocks with the result that of diving below white water to graze the larvae on rock surfaces requires that almost no effort be directed to fighting the current. Even very young ducklings can exploit the riffle areas, darting from a back eddy at the downstream face of one rock to that at the base of another. The black membranous flap that projects from either side of the bill's tip is clearly an adaptation associated with feeding. It has been variously suggested that this flap allows the bird to feel for its food and that it acts like a scraper. In truth, the flap is poorly endowed with nerve cells (so has no sensory function) but it may help remove clinging caddis. More likely, however, its principal function is to protect the edges of the bill from abrasion as the bird grovels amongst the rocks for its food.

BREEDING CYCLE

Breeding usually commences in August when the female commences feeding more avidly and for longer periods each day. Last season's nest site is revisited, provided eggs were successfully hatched there, and a shallow unlined scrape prepared to receive the eggs. Five or six white eggs are usually laid, although clutches as large as nine and as small as three have been found. Each egg weighs about 70g, close to 10% of the female's body weight and there is often a two-day interval between the laying of consecutive eggs of the clutch.

The female does all the incubation, retiring to the solitude of the nest, often in a river-side cave but variously beneath flax of grass clumps, in holes on the river bank, in hollow logs and rarely beneath a building, where her vigil extends for about 35 days - the longest incubation period for any species of duck. While his mate incubates, the male guards the territory and is especially alert for intruding birds whenever the female is off the nest feeding - usually early morning and late afternoon. However, he mixes vigilance with secretiveness and for much of the day remains inconspicuously on the river side, seldom far away from the nest site.

THE BROOD

The ducklings are immediately capable of battling strong currents. As an adaptation to their turbulent environment they are hatched with feet larger in proportion to their body size than those of other ducks. Soon they learn to scoot over the water top and jump up onto rocks, logs or ledges in their search for insect food. They feed by pecking at individual food items and even when they dive in search of food, as they often do, they peck at items one at a time. Both adults guard the young throughout their 90-100 days of development. The adults have distinct roles; the female is always close to the young ducklings, calling softly to them all of the time and so maintaining the cohesiveness of the brood. The male often trails behind the brood, constantly alert for danger, especially aerial predators such as hawks, gulls or shags, and for ducklings that linger behind their siblings. Only when the female and brood cease feeding and haul out on a log or rock to sleep does the male relax guardian duties and begin feeding.
is when the ducklings near fledging that the parents' interest in them starts to wane. Broods of ducklings still a week or two off flying have been found leading completely independent lives: their parents have commenced their annual moult and may be completely flightless, holing up in some cave by day and emerging to feed and make contact again with the chicks under the protective cover of darkness. This early moult is strange behaviour, but it has great importance for the adults. It means that they are likely to be full winged and through the moult by the time their young, and other ducklings take wing and start the serious business of finding living space on the river. Flightless adults still in the midst of moult may be less capable of combating these intruders and so run the risk of being evicted.

A PLACE TO LIVE

The quest for a place to live, and having found it, to hold it, appears to be a dominant feature in the life of blue duck. Yet in some respects the bird is poorly adapted to finding new habitat. It seems that all movements occur up and down the river course - there have been almost no reports of blue ducks flying over land, and a study made in Urewera National Park failed to find birds, banded in one catchment, over a ridge and in the next. In short, the bird is a poor disperser and long stretches of unsuitable river may prevent occupation of suitable habitat nearby. For this reason, the many small hydro-electric power schemes built in the headwaters of small rivers have been solid barriers to blue duck movement, and the changed character of the landscape and riverside activities of the lower reaches of other rivers likewise prevent exchange of birds between the headwaters of tributaries. This is how the now distribution has arisen, and how recolonisation of still good habitat is prevented.

POPULATION DYNAMICS

Blue ducks, upon attaining a territory, are long-lived; an average lifespan is 7-8 years but as many as one quarter of all birds will live 10 years or longer.

Such a long life presents many breeding opportunities but the dangerous nature of the habitat does not allow each attempt to succeed. As many as 40% of breeding attempts fail because nests are either flooded or predated. Duckling survival is affected mostly by the water conditions and weather at hatching and over the subsequent two weeks; high floods and rain lead to brood fragmentation and duckling death: However, 50-60% of the ducklings hatched usually survive to fledge.

Annual productivity per pair is low and variable. An average: of one fledgling per pair from an entire population would indicate that year as a productive one. But in some years, total breeding failure may occur, which means the production from any one year may need to compensate for adult deaths over several years.

BLUE DUCK LITERATURE

The behaviour and ecology of blue duck is under active study and several scientific papers are expected to be published over the next four years. Existing information includes:

1. J. Kear and T.H. Steel. 1971. Aspects of social behaviour in the blue duck. Notornis 18 : 187-98.

2. J. Kear. 1972. The blue duck of New Zealand. Living Bird 11 : 175-192

3. J.L. Eldridge. 1985. Display inventory of the blue duck. Wildfowl 36 : 109-121.

4. J.L. Eldridge. 1986. Territoriality in a river' specialist : the blue duck. Wildfowl 37 : 123-135

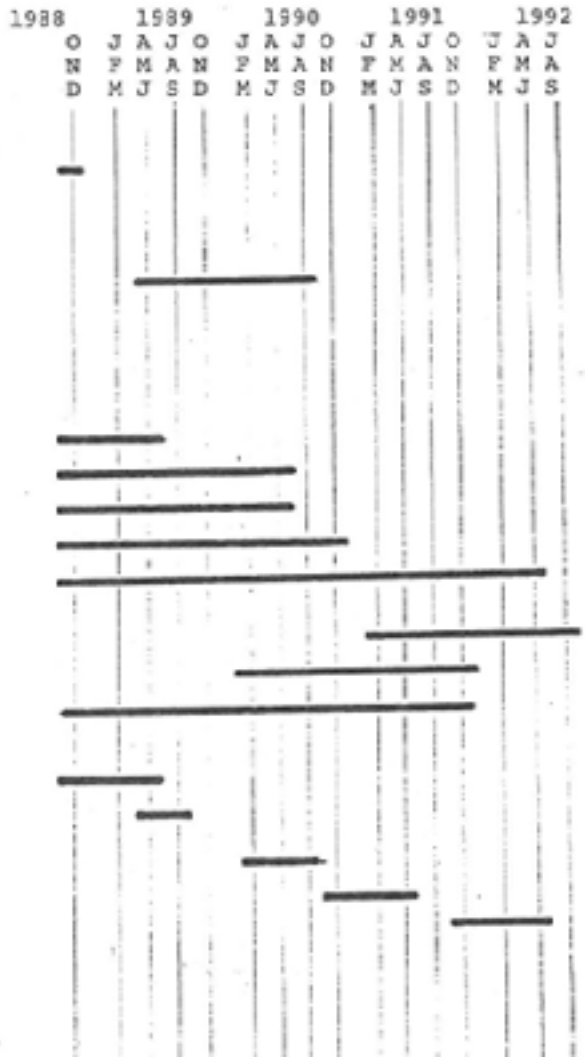
5. Reader's Digest Complete Book of New Zealand Birds

6. H. Guthrie-Smith. Birds of water, wood and waste.

7. M. Williams. 1988. proceedings of a blue duck conservation seminar. Dept. of Conservation Science and Research Internal Report No.13.

TIMETABLE OF ACTIVITIES

Centre of responsibility	Task
Department of Conservation Science & Research Directorate	1. Nationally available pamphlet (in association with Ducks Unlimited)
	2. Pictorial Book (in association with Regional or Central A&E Directorate
	3. Research topics - computerised record scheme - population genetics - dispersal characteristics - causes of decline - Manganuiateao population study - South Island productivity - productivity manipulation - impact of trout
Captive Breeding Group	1. Captive breeding plan - supply breeders
	2. Trial release plan - 1st release & monitor - 2nd release & monitor



Centre of responsibility	Task
Management Liaison Group	1. Informal liaison
	2. Activity review and co-ordination
	3. Seminar planning
	4. Revise conservation strategy
Ducks Unlimited	1. Static dislay
	2. Management liaison group
	3. Captive breeding