Classifying species according to threat of extinction

A system for New Zealand

THREATENED SPECIES OCCASIONAL PUBLICATION 22

Department of Conservation
Te Papa Atawhai

Classifying species according to threat of extinction

A system for New Zealand

Janice Molloy
Ben Bell
Mick Clout
Peter de Lange
George Gibbs
David Given
David Norton
Neville Smith
Theo Stephens

Biodiversity Recovery Unit
Department of Conservation
P.O. Box 10420
Wellington, New Zealand

This publication was prepared by Janice Molloy[1], Ben Bell[2], Mick Clout[3], Peter de Lange[4], George Gibbs[2], David Given[5], David Norton[6], Neville Smith[7] and Theo Stephens[8]. It was prepared for publication by DOC Science Publishing, Science & Research Unit; editing by Jaap Jasperse and layout by Jeremy Rolfe. Publication was approved by the Manager, Biodiversity Recovery Unit, Science Technology and Information Services, Department of Conservation, Wellington.

ISBN 0-478-22318-8

This publication may be cited as: Molloy, J.; Bell, B.; Clout, M.; de Lange, P.; Gibbs, G.; Given, D.; Norton, D.; Smith, N.; Stephens, T. 2002: Classifying species according to threat of extinction. A system for New Zealand. *Threatened species occasional publication 22*, 26 p.

Cover photo: The coxella weevil, *Hadramphus spinipennis*, is restricted to the Chatham Islands. This species' host plant is coxella speargrass, *Aciphylla dieffenbachii*, which is also endemic to the Chatham Islands. The speargrass (Nationally Vulnerable, with CD, HI, EF and OL qualifiers) is threatened by stock browsing on Chatham and Pitt Islands, and the weevil (Range Restricted, with HI and EF qualifiers) is confined to rodent-free islands such as Mangere Island. Photo by John Marris.

---

[1]Biodiversity Recovery Unit, Department of Conservation, PO Box 10 420, Wellington.

[2]School of Biological Sciences, Victoria University, PO Box 600, Wellington.

[3]Biological Science, Auckland University, PO Box 92 019, Auckland Central.

[4]Science & Research Unit, Department of Conservation, Private Bag 68 908, Auckland.

[5]Given and Associates, International Centre for Nature Conservation, Lincoln University, PO Box 84, Canterbury.

[6]School of Forestry, University of Canterbury, Private Bag 4800, Christchurch.

[7]Science Group, Ministry of Fisheries, PO Box 1020, Wellington.

[8]Science & Research Unit, Northern Regional Office, Department of Conservation, PO Box 112, Hamilton.

Foreword

New Zealand has some of the most ancient and fascinating species in the world (e.g. the tuatara). Many of our plants and animals are found nowhere else. But we are also world leaders in our rates of extinctions (particularly of land and freshwater birds, where nearly one-third have been lost), and in our levels of threatened species—a legacy of a history of unsustainable harvest, habitat destruction and alien species introduction.

Preventing the extinction of New Zealand's unique plant and animal species is a critical element in the Government's New Zealand Biodiversity Strategy: a responsibility we owe to the rest of the world. But this is not a small task.

A vital step in doing this is to identify those species that are at risk of extinction, and to measure the level and nature of that risk. This information will allow us to focus our resources on the highest priority actions necessary to prevent extinction.

Since 1992 the Department of Conservation has been using a system (generally known as the Molloy-Davis system) which ranks species according to their priority for recovery action. While that system has served us well, it was not without its weaknesses. With the subsequent recognition of the importance of integrated prioritising, and focusing on places, it became clear that we should separate the process of classifying the threats to species from prioritising species recovery actions. We also recognised the need for a threat classification system that could be used for all New Zealand's species groups, including marine species. A process to develop a new threat classification system was therefore initiated in 1999.

This document, by Janice Molloy and others, contains the result of that process. I would like to congratulate all those who have developed the new system. The quality of their work is shown by the fact that neither the final independent testing stage of development nor the actual application of the system identified the need for any significant changes. I would also like to place on record my appreciation for the willingness of experts from within and outside the Department to devote their valuable time to this exercise, and for the constructive approach they took to a sometimes controversial exercise. I believe that the product will be a major contribution to our efforts to prevent biodiversity loss.

The companion volume[1], compiled by Rod Hitchmough, presents the results of applying the system to classify all those species for which we have sufficient information. We are now able for the first time to provide an accurate threat classification for all those taxa for which information is available, ensuring that all those which are threatened receive the necessary attention to secure their future. I greatly appreciate the willingness of experts from within and outside the Department to share their knowledge and devote often substantial amounts of their valuable time to compiling this information, and their positive attitude to the threat classification system.

Hugh Logan
Director-General of Conservation.

---

[1] Hitchmough, R. (comp.) 2002: New Zealand Threat Classification System lists—2002. *Threatened species occasional publication 23*, 210 p.

CONTENTS

Abstract

This document describes a classification system that has been developed in New Zealand to list species according to their threat of extinction. The scope and the structure of the classification system are described and the process to be followed for listing taxa is outlined. The difference between this system and the priority setting system that the Department of Conservation (DOC) has used since 1992 is explained.

1. Background

Since 1992 the Department of Conservation (DOC) has based resource allocation decisions for species recovery programmes on a species priority-setting system. This system (Molloy & Davis 1992, revised in 1994) scores taxa against criteria that assess population status, impact of threats, recovery potential, taxonomic distinctiveness, and their value to humans; and categorises species according to their priority for conservation action.

In addition to species recovery programmes, initiatives aimed at managing and protecting important natural sites are increasing in number in New Zealand. These site-based programmes enable all of the values of a site (such as biological, historic and public enjoyment) to be managed in an integrated way.

DOC is currently developing a decision support framework to identify management priorities for sites (pers. comm. P. Warren 1999; Stephens *et al.* 2002). One factor that affects priorities will be the species present at the site. The threat status of the species and their taxonomic distinctiveness will be taken into account, as will other factors such as the importance of the site for the survival of the species.

DOC's intention is to integrate species recovery initiatives into site-based management programmes wherever possible. As a consequence of this, the need for a stand-alone species priority setting system will be reduced. However, the choice of management objectives for each site will be influenced by the threat status of species that occur there. This means some way of assessing the threat status of species will be needed.

Input into DOC decision-making processes is only one of several ways a species threat classification system could be used in New Zealand. A DOC workshop was held in March 1999[1] to identify potential uses and review the suitability of existing threat classification systems. Table 1 lists the uses identified by the workshop participants and the potential user groups.

[1] DOC Species Threat Classification Workshop, 23–24 March 1999, Wellington.

TABLE 1. USES AND USER GROUPS OF A SPECIES THREAT CLASSIFICATION SYSTEM

USE	USER GROUP
Input into DOC resource allocation decisions	DOC
Environmental monitoring (e.g. environmental indicators programme)	Government
Decisions relating to 'use' or 'take' of species (e.g. traditional harvest, eco-tourism, recreational and commercial harvest, bycatch in fisheries)	Government, iwi, concessionaires
Research priorities for research agencies/organisations	Universities, museums, Crown Research Institutes
Biodiversity protection through Resource Management Act	Local authorities
Biological evaluation of sites managed by organisations other than DOC	Non-Government organisations, local authorities, Ministry of Fisheries, iwi, QEII National Trust
General advocacy for species conservation	Government, Non-Government organisations, sponsors
International reporting and advocacy	Government, Non-Government organisations, international community

SPECIFICATIONS

The workshop participants agreed that the system would need to have the following specifications to be used in the ways outlined in Table 1:

1. Criteria that allow listing of marine, terrestrial and freshwater taxa.
2. Criteria that are sensitive to changes in population status.
3. Categories that separate naturally uncommon taxa from those that are currently threatened with extinction.
4. Categories that separate taxa according to the management response required.
5. Criteria that enable use of any relevant data when evaluating a taxon for listing.
6. Titles for categories that are widely understood.
7. Objective criteria that enable listings to be audited.
8. Numerical limits for criteria that take account of the population attributes of New Zealand taxa.

The workshop evaluated three possible classification systems: IUCN Red List categories (IUCN 1994), de Lange & Norton's classification system for New Zealand's threatened and uncommon plants (de Lange & Norton 1998; de Lange *et al.* 1999) and a subset of the criteria used in the DOC species priority setting system. The workshop found that none of the existing systems fulfilled all specifications, and recommended that a new classification system be developed using elements from all three.

As a result of the workshop and further development work by a small project team[2], a classification system has been developed for taxa that exist in the wild in New Zealand. Several rounds of consultation with species experts have occurred and a number of modifications have been made to take account of the suggestions received.

The need for further refinements may become evident after a complete listing process has been undertaken. A review of the system will occur at that time.

THREAT CLASSIFICATION SYSTEMS AND PRIORITY SETTING

Unlike the DOC Species Priority Setting System (Molloy & Davis 1992), the classification system described in this document does not assign management priorities between the different categories. Instead, the categories indicate the level of threat of extinction that taxa face. Although this is an important factor when making resource allocation decisions between recovery programmes, additional considerations such as feasibility, cost, and benefit to other taxa also influence these decisions (Stephens 1997; Stephens *et al.* 2002).

COMPARISON WITH THE IUCN RED LIST CATEGORIES

The international organisation IUCN (World Conservation Union) periodically publishes 'Red Lists' of globally threatened taxa. The IUCN Red List system has seven threatened categories, ranging from Extinct to Least Concern. Development of a system that is a best fit for the world's diverse geographic and ecological situations is a difficult task (de Lange & Norton 1998) and a recent review of the system has been undertaken to improve its application (IUCN 2000).

The classification system described in this document has been designed specifically for listing taxa that occur in New Zealand with the specifications described in Table 1 in mind. The categories and criteria bear some resemblance to those of the IUCN system, but differ in that they take account of the relatively small size of New Zealand, the period over which recent declines have occurred, and the large number of taxa with naturally restricted ranges and small population sizes.

This system is intended to complement the world view provided by the IUCN Red List. The New Zealand Threat Classification System is focussed at the national level, and will provide a more sensitive classification for taxa with naturally restricted distributions and small numbers as a result of this country's island and mountainous geography. Our system may suit other countries with similar requirements and similar geographic and ecological characteristics.

[2] Co-authors of the present document.

2. Scope of the New Zealand threat classification system

This classification system has been designed so that any taxon that exists in the wild in New Zealand[3] can potentially be listed (Fig. 1). Categories for both introduced[4] and non-introduced (native) taxa have been included, as well as categories for both threatened and non-threatened taxa. Finer-scale separation of levels of threat is provided for threatened taxa (seven categories) compared with non-threatened taxa (one category).

The classification system has been developed to apply equally to marine, terrestrial and freshwater biota. Any taxonomic entity can potentially be listed. Taxa are listed once only, at the lowest taxonomic level at which they have been described or recognition is proposed. For example if subspecies are listed, the species to which they belong will not be listed as well.

Two parallel lists are produced:

1. *Taxonomically distinct*: taxa that are published and generally accepted by relevant experts as distinct (species, subspecies, variety and forma).
2. *Taxonomically indeterminate*: Entities that are either published but not generally accepted as distinct, or taxa that are yet to be published.

The identity of indeterminate taxa should be established by listing voucher specimen numbers or referring to a published or filed photograph.

[3] Includes all terrestrial, freshwater and marine areas within the New Zealand Exclusive Economic Zone.

[4] Includes all introductions known to be by human agency, whether deliberate or accidental.

3. Classification structure and categories

The specifications that workshop participants identified as being essential for the classification system were used to guide development of the classification structure and the categories. This section describes each of the categories (shown in Fig. 1).

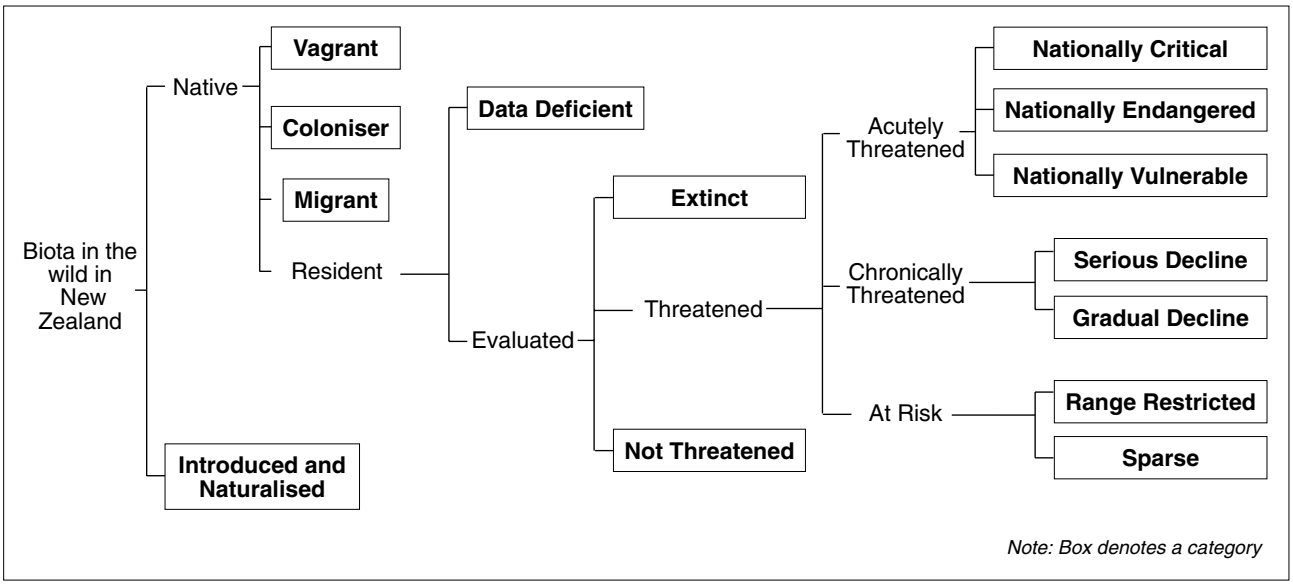

FIGURE 1. STRUCTURE OF THE NEW ZEALAND THREAT CLASSIFICATION SYSTEM.

INTRODUCED AND NATURALISED

Introduced and Naturalised taxa are those that have become naturalised in the wild after being deliberately or accidentally introduced to New Zealand by human agency.

If an Introduced and Naturalised taxon has an IUCN Red Listing in its country (or countries) of origin, the IUCN category and source of the listing are shown after the taxon's name in the New Zealand list. Current examples of this include the cress *Lepidium hyssopifolium* and the southern bell frog (*Litoria raniformis),* both of which are listed as Endangered in Australia; and the Parma wallaby (*Macropus parma*), listed as Lower risk/Near threatened.

VAGRANT

For the purposes of this document, vagrants are taxa that are found unexpectedly and rarely in New Zealand, and whose presence in our region is naturally transitory. These are taxa that do not establish themselves beyond their point of arrival because of reproductive failure or for specific ecological reasons (see de Lange & Norton 1998).

Examples include the red-kneed dotterel (*Erythrogonys cinctus)* and the blue moon butterfly (*Hypolimnas bolina nerina),* both from Australia, and the spotted sawtail (*Prionurus maculatus*) from the tropical south-west Pacific Ocean.

If a taxon in the Vagrant category has been listed in an IUCN Red List in its country of origin, the IUCN category and source of the listing are shown beside the taxon's name in the New Zealand list.

COLONISER

Colonisers are taxa that have arrived in New Zealand without direct or indirect help from humans and have been successfully reproducing in the wild for less than 50 years. Three examples are the Nankeen night heron (*Nycticorax caledonicus*), the scoliid wasp *Radumeris tasmaniensis* and the orchid *Cryptostylis subulata.*

The IUCN Red List category and source of the listing is included where this exists.

MIGRANT

Taxa that predictably and cyclically visit New Zealand as part of their normal life cycle, but do not breed here are included in the category Migrant. Examples include the Arctic skua (*Stercorarius parasiticus*) and striped marlin (*Tetrapturus audax*).

In contrast, taxa that either breed here and migrate beyond New Zealand during their life cycle, e.g. Chatham Island albatross (*Thalassarche eremita*), or taxa that are resident in New Zealand for most of their lives, such as longfinned eels (*Anguilla dieffenbachii*), are not included in this category.

The IUCN Red List category and source of the listing is included where this exists.

DATA DEFICIENT

The amount of information available for assessing the threat of extinction is highly variable between taxa and groups of taxa. At one extreme there are taxa such as kakapo, *Gunnera hamiltonii* and *Tecomanthe speciosa* where every wild individual is known, while at the other extreme there are taxa whose ecology and biology is virtually unknown (e.g. *Koeleria riguorum*, a recently described grass).

Certain criteria and/or definitions must be met for a taxon to be listed in a category. Where information is so lacking that an assessment is not possible, the taxon is assigned to the Data Deficient category. If a taxon is listed in a category other than Data Deficient but confidence in the listing is low due to poor quality data, then the listing can be qualified with the letters DP (Data Poor) to indicate this (see Section 6, item 5: p. 17).

EXTINCT

A taxon is listed as Extinct when there is no reasonable doubt, after repeated surveys in known or expected habitats at appropriate times (diurnal, seasonal and annual) and throughout the taxon's historic range, that the last individual has died. Examples include huia (*Heteralocha acutirostris*) and Adams's mistletoe (*Trilepidea adamsii*). Only taxa that have become extinct since 1840 are included in the list. Taxa that are extinct in the wild but occur in captivity or cultivation are not listed in this category. These are listed as Critically Endangered and are qualified with the letters EW (Extinct in the Wild—see Section 4, p. 15).

THREATENED

The threatened categories are grouped into three major divisions: 'Acutely Threatened', 'Chronically Threatened' and 'At Risk'.

Acutely Threatened

The categories in the 'Acutely Threatened' division—Nationally Critical, Nationally Endangered and Nationally Vulnerable—equate with the IUCN categories of Critically Endangered, Endangered and Vulnerable. Taxa in these three categories are facing a very high risk of extinction in the wild, as defined by criteria that quantify:

- Total population size
- Area of occupancy
- Fragmentation of populations
- Declines in total population
- Declines in habitat area
- Predicted declines due to existing threats

Although the criteria (described in Section 6) measure similar population features as those in the IUCN Red List criteria, numerical limits and timeframes are tailored to suit New Zealand circumstances. These were set through a process of testing and refinement by the project team and as a result of feedback from New Zealand species experts. Criteria that attempt to predict declines due to possible future threats are not included because of the highly speculative nature of this type of assessment.

Chronically Threatened

Taxa listed in either of the two categories in the 'Chronically Threatened' grouping (Serious Decline and Gradual Decline) also face extinction, but are buffered slightly by either a large total population, or a slow decline rate (see Section 6).

At Risk

Taxa that do not meet the criteria for Acutely Threatened or Chronically Threatened, but have either restricted ranges or small scattered sub-populations, are listed in one of two categories (Range Restricted and Sparse) that fall under the

division ‘At Risk’. Although these taxa are not currently in decline, their population characteristics mean a new threat could rapidly deplete their population(s). Range Restricted taxa either occur in a small geographic area (e.g. Three Kings Islands), are restricted to a particular habitat (e.g. geothermal areas), or require very specific substrates (e.g. ultramafic rock), and for colonial breeders, have fewer than 10 sub-populations. Taxa that have naturally restricted ranges and taxa that have become restricted as a result of human activities are both included in this category. This is because both would face the same risk of extinction in the face of a new threat. The two groups are differentiated by the use of a qualifier (see Section 4, next page).

Sparse taxa have very small, widely scattered populations, e.g. New Zealand spinach (*Tetragonia tetragonoides*). As with the Range Restricted category, taxa that are either naturally sparse or have become sparse as a result of human activities are included in this category.

NOT THREATENED

Taxa that are assessed and do not fit any of the Threatened categories are listed in the Not Threatened category.

4. Qualifiers

Two abbreviations, Data Poor (DP) and Extinct in the Wild (EW), have been described in Section 3. These abbreviations are termed qualifiers and provide additional information which adds meaning to the threat classification; they are an integral part of the classification of each taxon. There are eleven in total (Table 2). When a taxon is listed in a Threatened category, all of the qualifiers that apply to it are recorded.

TABLE 2. QUALIFIERS AND THEIR DEFINITIONS.

QUALIFIER	STANDS FOR	DEFINITION
EW	Extinct in the Wild	Exists only in cultivation or in captivity
CD	Conservation Dependent	Likely to move to a higher threat category if current management ceases
DP	Data Poor	Confidence in the listing is low due to the poor data available for assessment
RC	Recovering	Total population showing a sustained recovery
ST	Stable	Total population stable
SO	Secure Overseas	Secure in other parts of its natural range outside New Zealand
TO	Threatened Overseas	Threatened in those parts of its natural range outside New Zealand
HI	Human Induced	Present distribution is a result of direct or indirect human activity
RF	Recruitment Failure	Current population may appear stable but the age structure is such that catastrophic declines are likely in the future
EF	Extreme Fluctuations	Extreme unnatural population fluctuations, or natural fluctuations overlaying human-induced declines, that increase the threat of extinction
OL	One Location	Found at one location (geographically or ecologically distinct area) in which a single event (e.g. a predator irruption) could soon affect all individuals of the taxon

5. Nomination and assessment process

Previously, taxa were ranked against the DOC priority setting system (Molloy & Davis 1992, revised in 1994) by a group of species experts who usually met to undertake the task. Similarly, New Zealand indigenous vascular plants were assigned to threat categories (Cameron *et al*. 1993, 1995; de Lange *et al*. 1999) by a group of experts who collectively carried out the listing process. In both of these instances this process was found to work well, so the same method is used for listing taxa against the threat classification system described in this document.

Generally, listing is done in a meeting, although this is not essential. An independent person oversees all listings undertaken by each expert group to ensure the criteria are interpreted in a consistent way across taxonomic groups. The expert groups keep a record of all the information used in making the decision, including a summary of the criteria a taxon meets (if any) and the justification for the listing. This information will be used for auditing purposes, and to enable comparative evaluations to be made over time.

On rare occasions the category the taxon fits may be judged by the expert group to be inappropriate. If there is consensus within the expert group, the group assigns the taxon to an alternative category and keeps a written record for the decision. For consistency, every effort is made to use the listing process described here.

A wider group of specialists is given the opportunity to nominate taxa that they consider should be assessed by the expert group. These specialists provide the relevant data for the expert group to complete the listing.

Regular updating of the lists is envisaged every three years, or more frequently if required.

6. Listing process

Figure 2 outlines the step-by-step process used when listing taxa. Points of clarification about the listing process are:

1. Assessments are made on the status of the taxon irrespective of whether its current status is the result of management.
2. For indigenous taxa, the portion of the population that is resident in New Zealand is assessed.
3. For taxa that migrate to New Zealand and breed here, the portion of the total population that breeds in New Zealand is assessed against the Acutely and Chronically Threatened criteria.
4. When evaluating a taxon against the criteria, the expert groups use a precautionary approach. For instance, in situations where information about a taxon is poor, and a decision is being made between two categories, the higher threat category is chosen. When predicting future declines caused by existing threats, recent declines are used to project forward.
5. In cases where the information used to assess a taxon is poor, the expert group should make every effort to list the taxon in a threat category rather than assigning it to the Data Deficient category. The qualifier DP is used to indicate that there is uncertainty about the listing due to lack of data.
6. In cases where a taxon is currently declining after a human-induced population increase that expanded the population beyond its natural size (e.g. *Ranunculus urvilleanus*), the taxon is not listed in the Acutely or Chronically Threatened categories.
7. As soon as a taxon is reassessed against the system and does not meet the criteria of its category, it will be upgraded or downgraded to the appropriate category. This contrasts with the IUCN classification system which requires a period of 5 years to elapse before a taxon is downgraded.

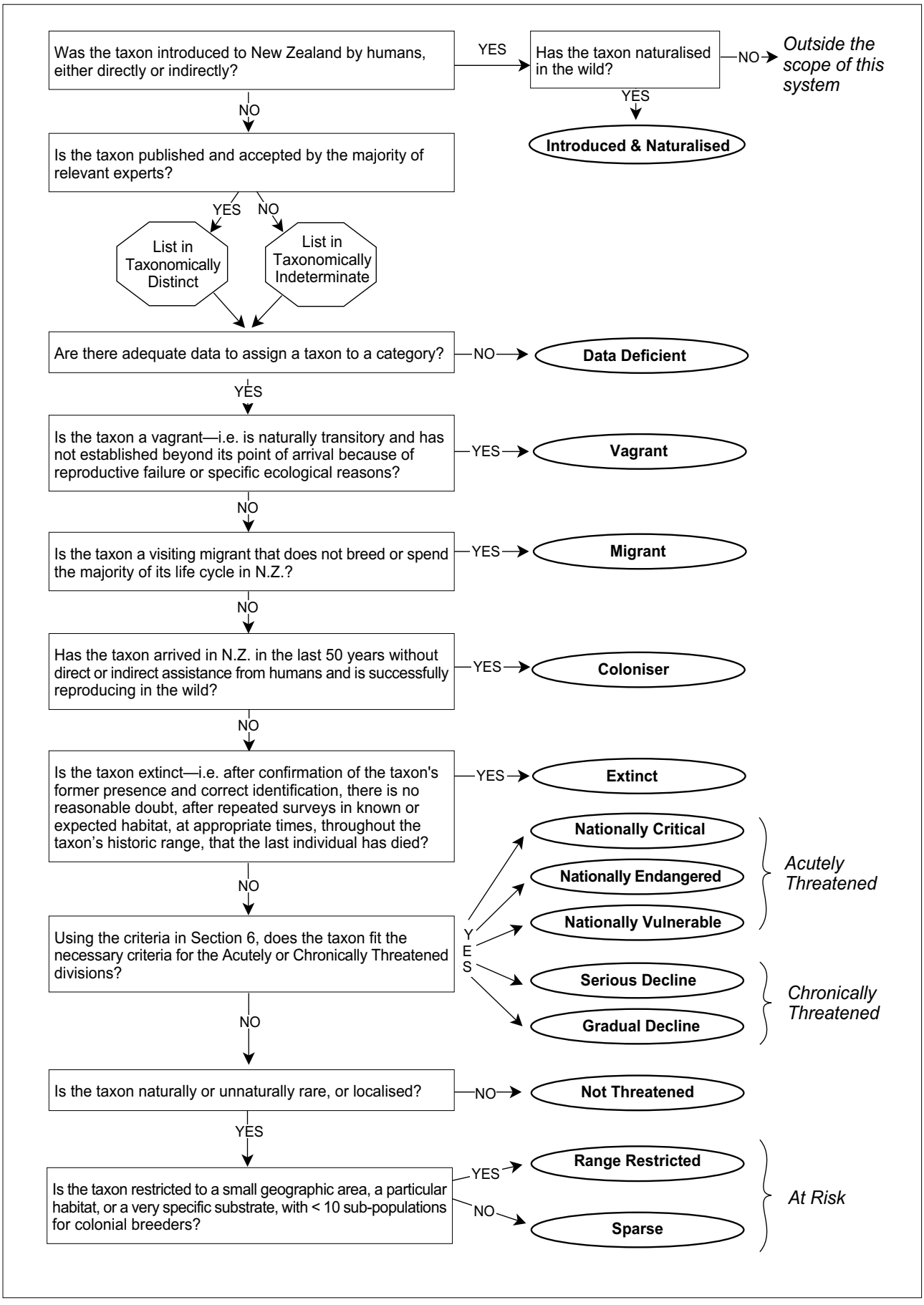

FIGURE 2. FLOWCHART FOR LISTING TAXA.

7. Criteria for the Acutely Threatened and Chronically Threatened categories

As illustrated in Fig. 2, a taxon must meet specific criteria to be listed in one of the Acutely Threatened or Chronically Threatened categories. The criteria for each category are set out below. Definitions of terms are given in Appendix 1.

NATIONALLY CRITICAL

Very small population *or* a very high predicted decline

A taxon is Nationally Critical when available scientific evidence indicates that it meets any of the following three criteria:

1. The total population size is ≤ 250 mature individuals.
2. Human influences have resulted in ≤ 2 sub-populations *and either*:
   a. ≤ 200 mature individuals in the largest sub-population, *or*
   b. the total area of occupancy is ≤ 1 ha (0.01 km^2).
3. There is a predicted decline of ≥ 80% in the total population in the next 10 years due to existing threats.

NATIONALLY ENDANGERED

A: Small population *and* moderate to high recent or predicted decline

A taxon is Nationally Endangered when available scientific evidence indicates that it fits at least one Status criterion *and* one Trend criterion as follows:

Status criteria

1. The total population size is 250–1000 mature individuals.
2. There are ≤ 5 sub-populations *and either*:
   a. ≤ 300 mature individuals in the largest sub-population *or*
   b. the total area of occupancy is ≤ 10 ha (0.1 km^2).

Trend criteria

1. There has been a decline of ≥ 30% in the total population or habitat area in the last 100 years.
2. There is a predicted decline of ≥ 30% in the total population in the next 10 years due to existing threats.

B: Small to moderate population *and* high recent or predicted decline

A taxon is Nationally Endangered when available scientific evidence indicates that it fits at least one Status criterion *and* one Trend criterion:

Status criteria

1. The total population size is 1000–5000 mature individuals.
2. There are ≤ 15 sub-populations *and either*:
   a. 300–500 mature individuals in the largest sub-population *or*
   b. the total area of occupancy is 10–100 ha (0.1–1 km^2).

Trend criteria

1. There has been a decline of ≥ 60% in the total population or habitat area in the last 100 years.
2. There is a predicted decline of ≥ 60% in the total population in the next 10 years due to existing threats.

NATIONALLY VULNERABLE

Small to moderate population *and* moderate recent or predicted decline

A taxon is Nationally Vulnerable when scientific evidence indicates that it fits at least one Status criterion *and* one Trend criterion:

Status criteria

1. The total population size is 1000–5000 mature individuals.
2. There are ≤ 15 sub-populations *and either*:
   a. 300–500 mature individuals in the largest sub-population *or*
   b. the total area of occupancy is 10–100 ha (0.1–1 km^2).

Trend criteria

1. There has been a decline of 30–60% in the total population or habitat area in the last 100 years *and the total population or habitat area is still in decline.*
2. There is a predicted decline of 30–60% in the total population in the next 10 years due to existing threats.

SERIOUS DECLINE

A. Moderate to large population *and* moderate to large predicted decline

A taxon is listed in Serious Decline when scientific evidence indicates that it fits at least one Status criterion *and* the Trend criterion:

Status criteria

1. The total population size is > 5000 mature individuals.

2. There are > 15 sub-populations *and either*:
   a. > 500 mature individuals in the largest sub-population, *or*
   b. the total area of occupancy is >100 ha (1 km^2).

Trend criterion

1. There is a predicted decline of > 30% in the total population in the next 10 years due to existing threats.

B. Small to moderate population *and* small to moderate predicted decline

A taxon is listed in Serious Decline when available scientific evidence indicates that it fits at least one Status criterion *and* the Trend criterion:

Status criteria

1. The total population size is < 5000 mature individuals.

2. There are ≤ 15 sub-populations *and either*:
   a. ≤ 500 mature individuals in the largest sub-population, *or*
   b. the total area of occupancy is ≤ 100 ha (1 km^2).

Trend criterion

1. There is a predicted decline of 5–30% in the total population in the next 10 years due to existing threats.

GRADUAL DECLINE

Moderate to large population *and* small to moderate decline

A taxon is listed in Gradual Decline when available scientific evidence indicates that it fits at least one Status criterion *and* the Trend criterion:

Status criteria

1. The total population size is > 5000 mature individuals.

2. There are > 15 sub-populations *and either*:
   a. > 500 mature individuals in the largest sub-population, *or*
   b. the total area of occupancy is > 100 ha (1 km^2).

Trend criterion

1. There is a predicted decline of 5–30% in the total population in the next 10 years due to existing threats, and the *decline is predicted to continue beyond 10 years*.

8. Review against specifications

The classification system meets each of the eight specifications described in Section 1. These are reviewed below:

1. *Criteria that allow listing of marine, terrestrial and freshwater taxa*

   Alternative criteria have been included to allow listing of marine, terrestrial, and freshwater organisms with different life histories and population characteristics. Only those criteria that are appropriate for assessing a particular taxon need be used. For instance, for fungi it would be difficult to assess population size because of the problem of defining the boundary of an individual. In this situation an estimate of area of occupancy may be easier.

2. *Criteria that are sensitive to changes in population status*

   One of the uses of the classification system is to monitor changes in the threat status of taxa over time. Taxa will be able to move from one category to another as their population size changes.

3. *Categories that separate naturally uncommon taxa from those currently threatened with extinction*

   This has been achieved by developing categories and criteria that separate taxa that have restricted ranges, are vagrants, recent colonisers, or are sparsely distributed, from taxa that are currently facing threats that are affecting their status.

4. *Categories that separate taxa according to the management response required*

   Many taxa in the At Risk categories only require population or threat monitoring whereas taxa in the higher threat categories are likely to require threat mitigation programmes. Recovery actions for taxa in the Vagrant, Migrant, and Introduced and Naturalised categories will usually need to be undertaken outside New Zealand. The key actions for taxa listed in the Data Deficient category are usually survey, monitoring and identification of threats.

   Qualifiers can also be used to sort taxa according to management requirements. For instance, taxa with the qualifier One Location (OL) may require establishment of new populations; those with the qualifier Recruitment Failure (RF) clearly require the causal agents of this to be identified and managed; taxa with the qualifier data poor (DP) require improved data collection programmes.

5. *Criteria that enable all relevant data to be utilised when evaluating a taxon for listing*

   Alternative criteria are provided for the Acutely and Chronically Threatened Categories, and not all criteria need be triggered for a taxon to be listed. This means, for instance, if the population size is unknown, but the area occupied is known, the taxon can still be assessed. Also, the criteria are designed so that if direct population status or trend data is not known, alternative indicative criteria can be used. For instance, data on decline rates may not be available, but the percentage of habitat lost may be able to be estimated.

6. *Titles for categories that are widely understood*

The titles for Acutely Threatened categories are derived from the IUCN categories of Critically Endangered, Endangered and Vulnerable. The addition of the word 'National' differentiates them from the IUCN system.

7. *Objective criteria that enable listings to be audited*

The criteria used for listing Acutely and Chronically Threatened taxa use numerical ranges for population status and trends. The expert groups record which criteria are met by each taxon, so that independent reviewers can audit listings. A thorough record is kept of all information used by the expert groups.

8. *Numerical limits for criteria that take account of the population attributes of New Zealand's biota*

The numerical limits used in the criteria were established by testing New Zealand taxa against the criteria, and refining the numerical limits. The project team assessed a range of different New Zealand taxa against the criteria during this process.

9. Acknowledgements

Many people have contributed to this project and it would be difficult to name them all. Particular thanks to the Conservation Policy Unit of DOC for sponsoring the project and to Paula Warren for her support and input at various stages. Rod Hitchmough contributed to the final text. The following people provided input on more than one occasion: Joseph Arand, Jessica Beever, Peter Buchanan, Kevin Collier, Ross Cullen, Wayne Hutchinson, Ken Hughey, Angus McIntosh, Carl McGuinness, Brian Molloy, Richard Molloy, Don Newman, Hugh Robertson, Graeme Taylor, David Towns, Andrew Townsend and Carol West. Chris Edkins provided the graphics and Jeremy Rolfe formatted the document and provided comments on an earlier draft.

10. References

Cameron, E.K.; de Lange, P.K.; Given, D.R.; Johnson, P.N.; Ogle, C.C. 1993: New Zealand Botanical Society threatened and local plants lists (1993 Revision). *New Zealand Botanical Society Newsletter* 32: 14–28.

Cameron, E.K.; de Lange, P.J.; Given, D.R.; Johnson, P.N.; Ogle, C.C. 1995: New Zealand Botanical Society threatened and local plants lists (1995 Revision). *New Zealand Botanical Society Newsletter* 39: 15–28.

de Lange, P.J.; Norton D.A. 1998: Revisiting rarity: a botanical perspective on the meanings of rarity and the classification of New Zealand's uncommon plants. *Royal Society of New Zealand Miscellaneous Series* 48: 145–160.

de Lange, P.J.; Heenan, P.B.; Given D.R.; Norton D.A.; Ogle, C.C.; Johnson, P.N.; Cameron, E.K. 1999: Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany* 37: 603–628.

IUCN 1994: IUCN red list categories. IUCN, Gland.

IUCN 2000: IUCN red list categories. IUCN, Gland.

Molloy, J.; Davis, A. 1992: Setting priorities for the conservation of New Zealand's threatened plants and animals. Department of Conservation, Wellington (revised in 1994).

Stephens, T. 1997: Measuring Conservation Achievement. *In*: Biodiversity Now! Joint Societies Conference, Wellington, 29 June–3 July 1997. Selected papers. *Ed*: P.M. Blaschke and K. Green. Department of Conservation, Wellington.

Stephens, R.T.T.; Brown, D.J.; Thornley, N.J. 2002: Measuring Conservation Achievement: concepts and their application over the Twizel Area. *Science for Conservation 200.* 114 p.

Appendix 1

DEFINITIONS OF TERMS

Definitions of terms used to define categories and criteria are listed below. Those derived from IUCN definitions are marked with an asterisk.

Population* The total number of individuals of the taxon that are resident, or that breed in New Zealand. For functional reasons, primarily owing to differences between life-forms, population numbers are expressed as numbers of mature individuals only. (See also definition of sub-population.)

Area of occupancy* The area occupied by the taxon, taking into account the fact that a taxon may not occupy all areas throughout its range because of unsuitable habitat. The smallest area essential at any stage in the life cycle of the taxon will be used (e.g. colonial nesting sites).

Colonisers Taxa that have arrived in New Zealand without direct or indirect help from humans and have been successfully reproducing in the wild for less than 50 years.

Extinct* After confirmation of the taxon's former presence and correct identification, there is no reasonable doubt, after repeated surveys in known or expected habitats, at appropriate times (diurnal, seasonal and annual) and throughout the taxon's historic range, that the last individual has died.

Habitat The sustaining ecosystem upon which the taxon depends. When estimating percentage decline of habitat area, include those areas where the *taxon* has not been able to complete all of its life cycle because of the presence of animals and plants that do not naturally occur there.

Introduced and Naturalised Taxa that have become naturalised in the wild after being deliberately or accidentally introduced to New Zealand by a human agency.

Migrant Taxa that predictably and cyclically visit New Zealand as part of their normal life cycle, but do not breed here.

Mature individuals* The number of mature individuals is defined as the number known, estimated or inferred to be capable of reproduction. When estimating this quantity the following points will be borne in mind:

- where the population is characterised by natural fluctuations the minimum number will be used;
- this measure is intended to count individuals capable of reproduction and will therefore exclude those whose reproductive capacity is suppressed in the wild through environmental, behavioural or other factors;
- in the case of populations with biased adult or breeding sex ratios it is appropriate to use lower estimates for the number of mature individuals, which take this into account (i.e. the estimated effective population size);
- reproducing units within a clone will be counted as individuals, except where such units are unable to survive alone (e.g. corals);
- in the case of taxa that naturally lose all or a subset of mature individuals at some point in their life cycle, the estimate will be made at the time when mature individuals are available for breeding.

Sub-population* Geographically or otherwise distinct groups in the population between which there is little exchange. Re-introduced wild populations must be self-sustaining before they are included as a sub-population. Populations held in captive institutions or grown in nurseries or gardens are not considered to be within the definition of sub-population, unless they are the only remaining individuals of the taxon.

Taxon (plural **taxa**) Any taxonomic entity that has been acknowledged by relevant experts (see definitions for taxonomically distinct and taxonomically indeterminate).

Taxonomically Distinct Taxa that are published and generally accepted by relevant experts as distinct (species, subspecies, variety and forma).

Taxonomically Indeterminate Taxa that are either published but not generally accepted as distinct, or taxa that are yet to be published.

Vagrant Taxa that are found unexpectedly and rarely in New Zealand and whose presence in this region is naturally transitory. These are invariably taxa that have failed to establish themselves beyond their point of arrival because of reproductive failure or for specific ecological reasons (see de Lange & Norton 1998).