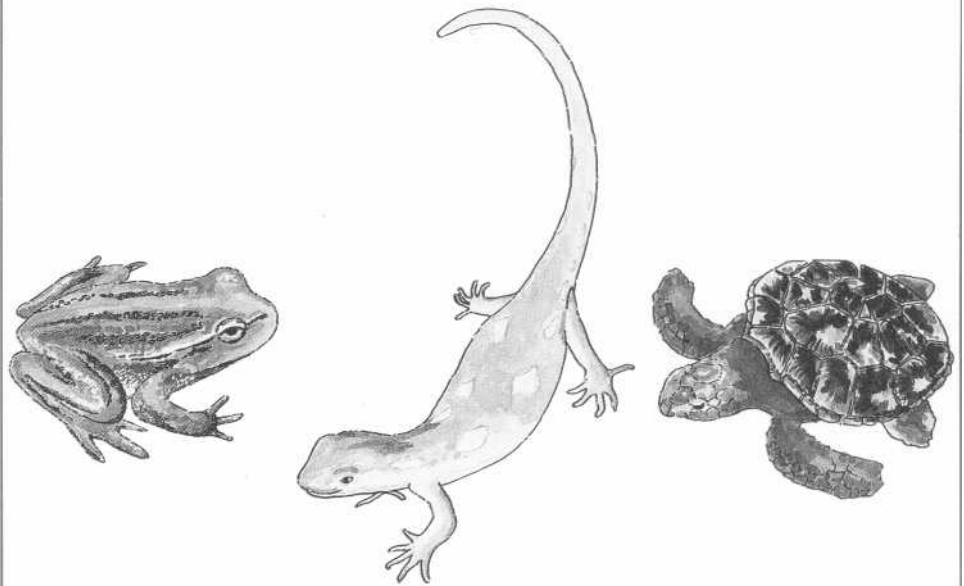


Atlas of the Amphibians and Reptiles of New Zealand

C.R. Pickard & D.R. Towns



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**ATLAS
OF THE AMPHIBIANS
AND REPTILES
OF NEW ZEALAND**

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We also wish to thank Don Newman, Bruce Thomas, Tony Whitaker and Drs Malcolm Crawley and Phil Moors for comments on the manuscript.

INTRODUCTION

New Zealand has approximately 60 species of amphibians and reptiles, with lizards (39 species) forming the largest single group. The lizard fauna is remarkable for its diversity in view of New Zealand's isolation, relatively small land mass and temperate climate. The distinctiveness of the herpetofauna has long been underestimated, with scientific emphasis being devoted largely to the endemic frogs (Leiopelmatidae) and the tuatara (Sphenodontidae) (Bell et al. 1985). Recent genetic studies of lizards show that they too represent a high level of endemism (Towns et al. 1985).

The terrestrial amphibian and reptile fauna as a whole is characterised by the elusiveness, identification difficulties and restricted distribution of most of the species. Many of them also are highly susceptible to environmental disturbance from various forms of land development, and some even to the subtle effects of uncontrolled browsing of forests (e.g. Newman and Towns 1985, Towns 1985). In most cases the potential impacts of development cannot be assessed confidently because the habitat requirements, status and distribution of the animals are poorly understood (Towns 1985). Distribution data in particular have been scattered through a number of agencies and individuals, and stored in forms from which retrieval is difficult.

In the late 1960s A. H. Whitaker (Ecology Division, DS IR) began collecting accurate information on the distribution of lizards in order to answer questions on the effect of land development on herpetofauna. In 1970 help was elicited from the New Zealand Herpetological Society, who for several years provided much distributional information. Eventually the scheme became an Ecology Division project and was handed on to Bruce Thomas (Ecology Division, Nelson) in 1977. Subsequently it became obvious that Ecology Division could not devote the staff and facilities required to develop an updated collation, storage and retrieval system, and in 1983 the unprocessed information was passed to the Wildlife Service (Department of Internal Affairs), which undertook to computerise the data.

The extent of the coverage of sources of raw data, and the speed with which the retrieval system was implemented, are largely due to assistance from the Department of Lands and Survey, which provided funds for C.R. Pickard through the Special Employment Scheme (in 1984).

The present report describes the amphibian and reptile distribution scheme now in operation for the Department of Conservation,

presents a summary of the data collected and collated so far, explains how the scheme works, suggests areas for future surveys, and provides instructions on how to contribute to the scheme.

Users of the system do not always require precise information about localities or habitats, but often are more interested in general distribution of a species. To serve these requirements maps based on 10000 yard grid squares are provided here using all data so far made available to us.

Distribution recording schemes will function effectively only if there is a large, up-to-date data base from which data can be retrieved rapidly. This report has been produced to announce that the scheme is now operating, to publicise the need for further distribution records and ultimately to increase the quantity and quality of information available.

THE DISTRIBUTION SCHEME

The computer system

Data collected for the New Zealand amphibian and reptile distribution scheme was stored originally on a North Star Horizon micro-computer, using dBASE II (a rational data base management package produced by Ashton-Tate), but currently resides on an Apricot XEN microcomputer. To date over 4000 sightings from 435 contributors have been processed. Computerisation of the data base has made it possible to recall species data for any given observer or location (the latter by map sheet number, grid square, or island). The concept of the original herpetological data collection scheme has been modified and now the scheme records the distribution of frogs, tuatara, lizards, freshwater and marine turtles and sea snakes. This involves a named fauna of 55 species, comprising three species of native and three of introduced frogs, 17 species of geckos, 22 species of skinks, two species of introduced turtles, five species of marine turtles and three species of marine snakes (Table 1). In its present form, the scheme does not include every known location for all species. For some locations information is too imprecise to be usable, and until the sites have been checked they will remain unrecorded.

Table 1. Species names recognised by the distribution scheme and their suggested common names. Species listed and/or proposed for Red Data Book inclusion are marked *, those for which unspecified reports are available are marked †.

FROGS

SPECIES	SUGGESTED COMMON NAME(S)	Map No.
<i>Leiopelma archeyi</i> *	Archeys' frog	5
<i>Leiopelma hamiltoni</i> *	Hamilton's frog	5
<i>Leiopelma hochstetteri</i> *	Hochstetter's frog	6
<i>Litoria aurea</i>	golden bell frog	7,8
<i>Litoria ewingi</i>	whistling (brown Australian tree frog)	9, 10
<i>Litoria raniformis</i>	green tree frog	7, 8

LIZARDS

<i>Naultinus elegans elegans</i>	common (Auckland) green gecko	14
<i>Naultinus elegans punctatus</i>	common (Wellington) green gecko	14
<i>Naultinus grayi</i>	Northland green gecko	14
<i>Heteropholis gemmeus</i>	jewelled gecko	16
<i>Heteropholis manukanus</i>	Marlborough green gecko	
<i>Heteropholis poecilochlorus</i>	Lewis Pass green gecko	15
<i>Heteropholis rudis</i>	rough(-scaled) gecko	16
<i>Heteropholis stellatus</i>	Nelson green gecko	15
<i>Heteropholis tuberculatus</i>		16
<i>Hoplodactylus</i>		
<i>chrysosireticus</i> *	goldstripe gecko	17
<i>Hoplodactylus delcorti</i> †		
<i>Hoplodactylus duvauceli</i>	Duvaucel's gecko	18, 19
<i>Hoplodactylus granulatus</i>	forest gecko	18, 19
<i>Hoplodactylus kahutarae</i> *	black-eyed gecko	23
<i>Hoplodactylus maculatus</i>	common gecko	20,21
<i>Hoplodactylus pacificus</i>	Pacific gecko	22
<i>Hoplodactylus rakiurae</i> *	harlequin (Stewart Island) gecko	23
<i>Hoplodactylus stephensi</i> *	Stephens Island gecko	23
<i>Cyclodina aenea</i>	copper skink	24
<i>Cyclodina alani</i> *	robust skink	26
<i>Cyclodina macgregori</i> *	Mcgregor's skink	27
<i>Cyclodina oliveri</i>	marbled skink	26
<i>Cyclodina ornata</i>	ornate skink	25
<i>Cyclodina whitakeri</i> *	Whitaker's skink	27
<i>Lampropholis delicata</i>	rainbow skink	27
<i>Leiopisma acrinasum</i>	Fiordland skink	35
<i>Leiopisma chloronoton</i>	green skink	30
<i>Leiopisma fallai</i>	Three Kings skink	28
<i>Leiopisma gracilicorpus</i> * †		
<i>Leiopisma grande</i> *	grand skink	35
<i>Leiopisma homalonotum</i> *	chevron (Great Barrier) skink	28
<i>Leiopisma infrapunctatum</i>	speckled skink	37, 38
<i>Leiopisma lineocellatum</i>	spotted skink	29, 30
<i>Leiopisma moco</i>	moko skink	31
<i>Leiopisma nigriplantare</i>		
<i>maccanni</i>	common skink	32, 33

<i>Leiopisma nigriplantare</i>	Chathams skink	
<i>nigriplantare</i>		
<i>Leiopisma ottagense</i> *		
f. <i>ottagense</i>	Otago skink	36
f. <i>waimatense</i>	scree skink	36
<i>Leiopisma smithi</i>	shore skink	34
<i>Leiopisma striaturh</i> *	striped skink	28
<i>Leiopisma suteri</i>	egg-laying (Suter's) skink	29
<i>Leiopisma zelandicum</i>	brown skink	37,38

TUATARA

<i>Sphenodon punctatus</i> *	tuatara	11
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TURTLES

<i>Chelodina longicollis</i>	long (snake)-necked turtle	41
<i>Chrysemys scripta elegans</i> †	red-eared terrapin	
<i>Caretta caretta gigas</i> *	Pacific loggerhead turtle	42,43
<i>Chelonia mydas</i> *	green turtle	40
<i>Dermachelys coriacea</i> *	leathery turtle	41
<i>Eretmochelys imbricata</i> *	hawksbill turtle	41
<i>Lepidochelys olivacea</i> * †	Olive Ridley turtle	

SNAKES

<i>Laticauda colubrina</i>	banded sea snake	39
<i>Laticauda laticordata</i> †		
<i>Pelamis platurus</i>	yellow-bellied sea snake	39

Nomenclature

The nomenclature used in this scheme is that currently accepted for frogs (e.g. Bell 1982), skinks (Hardy 1977) and geckos (Robb and Rowlands 1977, Robb 1980, Robb and Hitchmough 1980, Thomas 1981, Whitaker 1984, Bauer and Russell 1986). The nomenclatures of Wells and Wellington (1985) and Gill (1986) are not accepted here. Table 1 lists the species names used, provides suggested common names (based on Newman [1982]), and identifies the rarest species.

These latter are species listed in the Red Data Book of New Zealand (Williams and Given 1981), were proposed by the Wildlife Service for inclusion in the IUCN Red Data Book (lizards) or are included already in the IUCN lists (Goombridge 1982) (tuatara and marine turtles). The conservation status of all species of herpetofauna is summarised by Bell (1986).

Identification of species

The most difficult part of assisting in the scheme (apart from finding animals) will be identifying species correctly. New Zealand frogs are well covered in the keys by Bell (1982) and Gill (1986) and recently published field guides should help with identification of lizards (Towns 1988, Gill 1986). A useful photographic guide to terrestrial species is provided by Barnett (1985).

What maps to use

The scheme has been compiled using inch to the mile maps (1:63360), which allow the data to be plotted on a 10000 yard grid square system. In recent years sheets of the NZMS 1 and 18 series maps have been taken out of print. In their place are metric equivalents -the NZMS 260 and 262 series maps. To allow for this a computer programme has been developed which converts imperial references to metric equivalents, or *vice versa*. The system will therefore accept imperial or metric grid references, but only for NZMS 1, 18, 260 and 262 series maps.

How to fill in a card

The present distribution card is a modified version of the card developed for the Ornithological Society of New Zealand to record observations of birds. The size and format of the card are a compromise between adequate space for clear writing, convenient pocket or note book size and ease of entry of the data into the computer. When filling in the card please ensure that either a legible, sharp pencil or a ball point pen is used.

Distribution scheme cards can be filled in by anyone who can identify amphibians and reptiles accurately or who can take a good photograph.

Cards can be filled in at any time of year, but many amphibians and reptiles are most likely to be visible over the spring-summer-autumn period. A new card should be filled in for each change in location or new day.

The following notes refer to the card filled in as an example in Fig. 1.

Card:		NEW ZEALAND AMPHIBIAN/REPTILE DISTRIBUTION SCHEME		Code:	
Department of Conservation, PO Box 10420, Wellington					
Observer: Ima R. SAMPLE	Date: 17/7/85	Locality Name:			
Initials: _____ Surname: _____	Alt. (M): 1700 (ft)	The Crater, Taieri Ridge			
Address: 77 Constance Terrace		Central Otago			
Ilam					
Christchurch					
Affiliation: NZHS					
		Series	Number	Grid	Reference
		0 0 1 X	1 4 5	3 9 2 9	3 2 3 1
Species Name	No.	Time	Habitat	Weather	Major Habitat Types
1 L. grande	2	1405	15/08 g,d	Light	1 Beech forest
2 L. ottagense				1 Fine/sunny	2 Podocarp forest
3 "otagense"	1	1415	15/08 f	2 Part cloudy	3 Broadleaf forest
4				3 Overcast	4 Exotic forest
5				4 Showers	5 Scrub
				5 Rain	6 Sub-alpine
				Temperature	7 Alpine
				1 Hot	8 Undeveloped tussockland
				2 Warm	9 Developed farmland
				3 Moderate	10 River terrace
				4 Cool	11 Fresh water
				5 Cold	12 Wet land
				Wind	13 Coastal
				1 Calm	14 Suree
				2 Light breeze	15 Bare rocks
				3 Mod breeze	16 Beach
				4 Gusty	17 Urban
				5 Strong winds	18
Voucher specimen/photograph	Yes/No				19
Extra notes on reverse side	Yes/No				
Identified by: I. Expert					
Authority used: A.N. Other (1986)					
					Micro habitats
					A Foliage
					B Trunk
					C Branches
					D Under stones
					E Under wood
					F Open ground
					G Crevices
					H

Fig. 1. Sample of distribution card.

Card No./Code:	Please leave blank.
Observer:	Enter your name (or if more than one person is involved in the observation, the leader's name) on every card filled in. Cards are coded on the computer using the first four initials of the observer's name. On the first card completed it is useful to give all Christian names, thereafter initials will suffice.
Address:	For each series of cards filled in make sure that the address is on the first card of the series. Please notify us of changes of address so that if necessary you can be contacted.
Affiliation:	Enter the name of the organisation for which the survey is being undertaken, e.g. NZ Herpetological Society, a university, Department of Conservation. If a private individual, please note this (none).
Date:	Enter the day, month and year, as follows e.g. 17.7.85.
Alt (m) :	The altitude will be recorded automatically in the computer in metres above sea level. When working from Imperial measure maps give the altitude in feet (but indicate that you have done so), and this will be converted to metres by the computer.
Locality:	From the map used give the locality name nearest to your sighting and, if possible, provide a more general location name. This location name can be used for detecting errors in the grid reference.
Series:	Give the New Zealand map series number of the map being used. Usually this should be NZMS 1(1:63360: inch to the mile) or NZMS 260 (1:50000; 2 cm to 1 km). Please do NOT use other map series.
Number:	The map sheet number is prefixed by "N" for North Island, "S" for South Island, or "x" for places lacking the national or NZ map grids, e.g. some offshore islands. Circle whichever applies. The sheet number is three characters

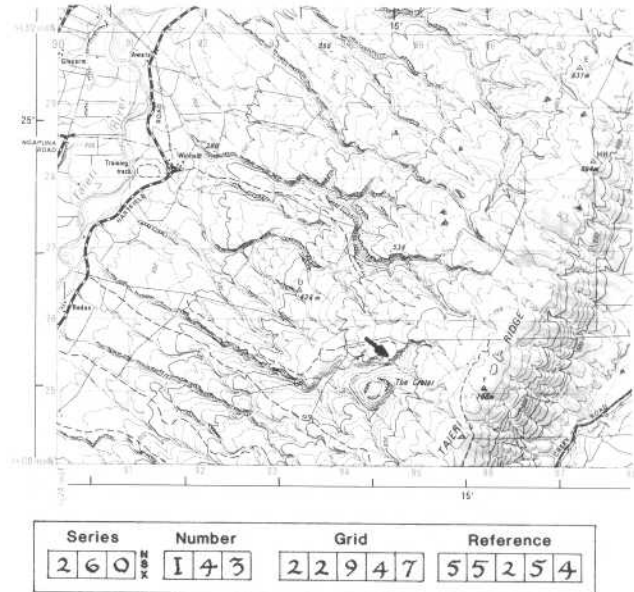
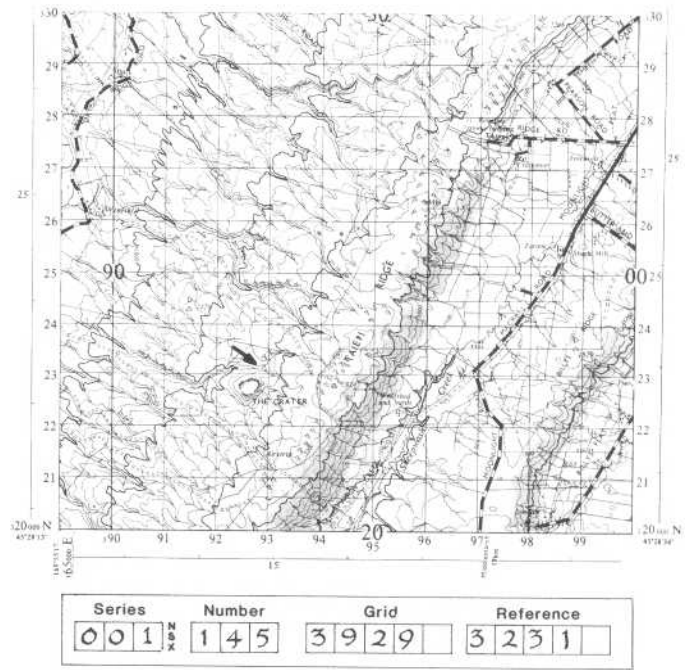


Fig. 2. Examples of grid references using Imperial (upper) and metric (lower) maps.

long. For the NZMS 260 series maps the first character is a letter of the alphabet (see Fig. 2). Where the map number is fewer than three characters long, fill the preceding blanks with zeros, e.g. sheet 7 becomes number: 007.

Grid Reference:	<p>if possible give a full grid reference defining the location of the sighting to the nearest 100 yards or metres. This results in an 8-digit number on Imperial measure maps and a 10-digit number on metric maps. The grid reference is divided equally into two parts - an easting and a northing.</p> <p>The easting is read from the top or bottom edge of the map. The first digit(s) of the easting part of the grid reference will be the small number(s) to the left of the sighting (e.g. 3). The next two digits are those directly below the nearest vertical line to the left of the sighting (e.g. 92). The last figure is an estimate in tenths of the distance between the point of sighting and the nearest vertical line to its left (e. g. 9).</p> <p>This procedure is repeated for the northing using the horizontal line directly below the sighting as a reference point (e.g. 3231, see Fig. 2). Using the example card (Fig. 1), the appropriate grid reference to the nearest 100 yards and 100 metres are shown in Fig. 2. In most cases we can accept observations given to the nearest 10000 yards or metres (e.g. 39 32 and 229 552 respectively.)</p>
Species name:	Enter the names of all species seen at a given grid reference <i>using the nomenclature provided in Table 1.</i>
No.:	Where possible give the number of individuals seen for each species.
Time:	Note the time at which the animals were seen in 24-hour clock notation, e.g. 2.05 pm = 1405 h (note S if in summertime [daylight saving]).

Habitat:	<p>Circle one or more of those habitats listed which most closely describe where the observations were made. As an example, Central Otago high country is a mixture of farmland and tussock land with some scrub. The coding could therefore be 9/8/5. Code numbers 18 and 19 are left blank for your definition.</p> <p>Also circle up to two of the microhabitat definitions. These categories can be taken as broad definitions, i.e. "D", under stones can be defined as under boulders, concrete slabs, bricks etc.</p> <p>If more than one species is being recorded and the habitat types differ, the various habitat choices can be written in the space provided and marked "Habitat".</p>
Weather:	<p>Circle the appropriate category for "Light", "Temperature" and "Wind" at the time of observation.</p>
Voucher specimen/ photograph	<p>Permits issued by the Department of Conservation are required before protected species can be captured and handled (see "Permits"). Such species should only be captured and removed under exceptional circumstances. Photographs are a particularly useful check for identification. If an animal was captured and removed, or photographed, please indicate.</p>
Extra notes:	<p>If extra notes were recorded about the animal seen (e.g. weight, measurements, general description), or about the area in which the animal occurred, circle the appropriate category. Notes can be written on the back of the card.</p>
Identified by:	<p>If the observer was not the person who identified the animal then enter the identifier's name.</p>
Authority used:	<p>Cite the reference used to identify the species name of the animal.</p>

Data coverage and search intensity

The 10000 yard grid square system of mapping requires 1614 squares to cover the North Island and 2061 squares to cover the South Island (including Stewart Island and its smaller neighbours). Although the two maps showing total coverage of records have a fair scatter of points (Figs 12 and 13), herpetological distribution records were available from only 21 % of the total area available in both islands and in many areas these involved a single specimen or a single sighting. Very few have been subjected to an intensive square-by-square search for amphibians and reptiles. Areas where this has occurred include Pureora Forest (Forest Research Institute survey, 1985), Lindis Pass (Wildlife Service, 1984), Macrae's Flat, Nenthorn, Mt Ida, Queens-town, Alexandra and Wanaka (Wildlife Service 1984, 1985, 1986) and Sutton (Department of Conservation 1987). Parts of Stewart Island and many northern offshore islands have also been quite carefully checked.

The following maps are based upon data obtained from active surveying, searching through manuscripts and reports and data from museum accession records, some of which date from the turn of the century. The latter source comprises 30% of the data base, so many areas require checking through additional surveys.

Reading the computer output

Computer outputs may be provided for *bonafide* requests for information. In these outputs the computer provides one line of printout for each distribution card record. As each line is 130 characters long, the key given in Table 2 can be used to decipher the stretched format. The data used in Fig. 1 have been used as an example.

Use of the data

Apart from expanding an extremely fragmentary data base on amphibians and reptiles in New Zealand, increased interest in contribution to the distribution scheme can have several useful purposes. Firstly, undescribed species of lizards are almost certainly in existence, and photographs used to supplement observations could help to identify them and give precise data about their location. Secondly, a number of species of frogs, lizards and perhaps turtles have been accidentally or deliberately introduced into New Zealand. One lizard and three frog species are widespread as a result. Such liberations are illegal under present legislation, but it is possible that

Table 2. Example of stretched format computer printout

```

Line 1
00912          00914    IS      NIS      170785          520
Computer No.   Card No. Observer  Affiliation  Date            Altitude
                (Initials)                    (Metres)

Line 1 contd.
001           N      145       3929      3231          5254
Map Series    Map Set  Sheet No.  Easting  Northing      Northing
                |
                -----IMPERIAL-----METRIC-----
Line 1 contd.
1             2      3       1405      48           Leiolopisma grande
Light         Temperature  Wind     Time     Species Code No.    Species name

Line 1 contd.
ID CONFIR     2       15'08'NA    C'D        Micro habitat Codes   Habitat notes?   Extra notes?   N   N
ID Status    No. Screen  Major habitat Codes  C/D             Species Code No.    Species name

Line 1 contd.
N
Voucher Specimen/Photo-graph?  This is an example Card
                                Comments
  
```


additional species have become established in the wild and have yet to be reported. Thirdly, for native species increased information about distribution, abundance and habitat requirements is being used in planning for reserves and as a guide to areas in which more intensive work is required.

PERMIT

Permits are required from the Department of Conservation for handling all protected species, and for handling all species in protected areas. Outside reserves, no permits are required when distribution data are to be based upon introduced species and the four unprotected species of lizards (*Leiopisma nigriplantare maccanni*, *Cyclodina aenea*, *Hoplodactylus maculatus*, and *H. granulatus*). Many of the protected species are very rare or highly restricted in distribution and the legislation protecting these animals is therefore enforced strictly. Because it will not be possible to identify many species without handling them, applications to carry out surveys involving protected species should include details of the areas to be covered, names of the people involved in the survey and dates of the survey period. Permits may be given to private individuals when competence in herpetology can be demonstrated, but in most cases it is preferred that the work is co-ordinated through the New Zealand Herpetological Society. A condition of all permits issued is that a report on the work carried out is forwarded to the Department of Conservation office providing the permit. Where surveys are conducted, returning the completed amphibian and reptile distribution cards is usually regarded as a substitute for a written report.

It should be remembered that marine snakes and turtles are members of the native fauna of New Zealand. All turtles known from waters around New Zealand are internationally recognised as endangered and should not be captured or disturbed unless clearly distressed or injured. Remember also that the marine snakes are venomous and should not be approached too closely. On the other hand, there is no reason to destroy them - they are protected as strictly as our land reptiles under the enactments administered by the Conservation Act.

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